92d Congress, 2d Session - - - - - - - - - - - House Document No. 92-198

NORTH SHORE OF LONG ISLAND, SUFFOLK COUNTY, NEW YORK

LETTER

FROM

THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY, DATED DECEMBER 3, 1970, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND AN ILLUSTRATION, ON NORTH SHORE OF LONG ISLAND, SUFFOLK COUNTY, NEW YORK, IN RESPONSE TO RESOLUTIONS OF THE COMMITTEES ON PUBLIC WORKS, UNITED STATES SENATE AND HOUSE OF REPRESENTATIVES, ADOPTED MARCH 20, 1963 AND JUNE 19, 1963, RESPECTIVELY, AND ALSO IN PARTIAL RESPONSE TO PUBLIC LAW 71, EIGHTY-FOURTH CONGRESS, FIRST SESSION, APPROVED JUNE 15, 1955

APRIL 13, 1972.—Referred to the Committee on Public Works and ordered to be printed with an illustration

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U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1972

NORTH SHORE OF LONG ISLAND, SUFFOLK COUNTY, NEW YORK

LETTER

FROM

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A LETTER FROM THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY, DATED DECEMBER 3, 1970, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND AN ILLUSTRATION, ON NORTH SHORE OF LONG ISLAND, SUFFOLK COUNTY, NEW YORK, IN RESPONSE TO RESOLUTIONS OF THE COMMITTEES ON PUBLIC WORKS, UNITED STATES SENATE AND HOUSE OF REPRESENTATIVES, ADOPTED MARCH 20, 1963 AND JUNE 19, 1963, RESPECTIVELY, AND ALSO IN PARTIAL RESPONSE TO PUBLIC LAW 71, EIGHTY-FOURTH CONGRESS, FIRST SESSION, APPROVED JUNE 15, 1955

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U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1972

76-424 O

130. Low-lying shore areas at Asharoken Beach, Crab Meadow, Port Jefferson Harbor, and Hashamomuck Beach have been inundated by high tides during hurricane storms. This inundation has resulted in flood damage to property and hardships to families in these areas. The hurricane of 31 August 1954 which produced the maximum tides of record in the study area, caused total known damages in excess of $700,000 (1954 prices). Recurrence of this storm would cause a total of $1,083,800 (March 1969 prices) in primary physical and non-physical damages in the study area.

131. REQUESTS OF LOCAL INTERESTS. At the public hearing held at Riverhead, New York, on 19 January 1956, local interests and private individuals requested various types of improvement, such as groins along shores fronting high bluff areas, road raising and beach improvements along low-lying shore areas, and bluff protection for areas where residential developments are threatened. At Caumsett, Sunken Meadow and Wildwood State Parks, studies were requested to prevent storm damages. Also, a localized storm warning system and information for eastern Long Island were requested to aid property owners in fighting erosion and tidal flooding.

132. PLANS CONSIDERED. Plans of improvement for shore protection were considered for Caumsett, Sunken Meadow and Wildwood State Parks. Plans of improvement for hurricane protection were also considered for Asharoken Beach and Port Jefferson Harbor. The plans considered for the three State Parks were found to be economically feasible. However, local interests later requested that no further consideration be given to the improvements at Caumsett and Wildwood State Parks. The improvements considered at Asharoken Beach and Port Jefferson Harbor were found not economically justified by the evaluated benefits. Detailed consideration was not given to problem areas where there was insufficient public ownership or use. However, plans of improvement and corrective measures that may be undertaken by local interests were suggested for these problems. In problem areas such as at Old Field Point, Scotts Beach and Wading River Landing the State has constructed shore protection improvements. The barrier beach at Asharoken Beach is still overtopped even though massive beach fills have been placed. Erosion problems at Short Beach and Cedar Beach have been corrected by spoiling of beach material dredged from adjacent harbors.

133. A storm warning system has been instituted by the Suffolk County Civil Defense Office in cooperation with the U. S. Weather Bureau Office in New York City. However, hurricane preparedness plans within affected communities need to be developed in accordance with National Research Project Report No. 28 of the Weather Bureau entitled "Model Hurricane Plan for a Coastal Community" which is included in appendix N of this report.

134. CONSIDERED PLAN. The considered plan of improvement at Sunken Meadow State Park, New York, including the shore at Callahans Beach, would provide for beach restoration and widening of 13,450 feet of the shorefront by the artificial placement of about 1,280,000 cubic yards of beach fill. The required beach fill would be obtained from offshore borrow sources in Smithtown Bay. A terminal jetty would be provided at the entrance to the Nissequogue River to minimize losses of beach fill into the entrance channel.

APPENDIXES ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER
(Only Appendixes J and M printed)

Appendix:

ILLUSTRATIONS ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER

(Only Plate 41 printed)

LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20310

April 5, 1972

Honorable Carl Albert
Speaker of the House of Representatives
Washington, D. C. 20515

Dear Mr. Speaker:

I am transmitting herewith a favorable report dated 3 December 1970, from the Chief of Engineers, Department of the Army, together with accompanying papers and an illustration, on North Shore of Long Island, Suffolk County, New York, in response to resolutions of the Committees on Public Works, United States Senate and House of Representatives, adopted 20 March 1963 and 19 June 1963, respectively, and also in partial response to Public Law 71, Eighty-fourth Congress, first session, approved 15 June 1955.

The views of the State of New York and the Departments of the Interior, Transportation, and Health, Education, and Welfare are set forth in the inclosed communications. The environmental statement required by the National Environmental Policy Act has been submitted to the Council on Environmental Quality.

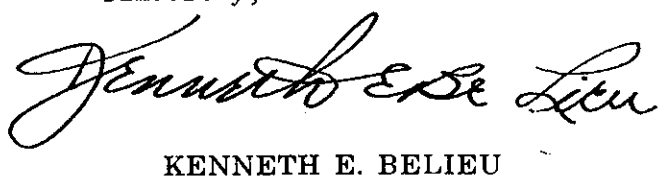
Since this project meets all the requirements of Section 201 of the Flood Control Act of 1965 and involves little or no controversy, I recommend that the project be approved for appropriations.

The Office of Management and Budget advises that there is no objection to the submission of the proposed report to the Congress; however, it states that no commitment can be made at this time as to when any estimate of appropriation would be submitted for construction of the project, if approved for appropriations, since this would be governed by the President's

Honorable Carl Albert

budgetary objectives as determined by the then prevailing fiscal situation. A copy of the letter from the Office of Management and Budget is inclosed as part of the report.

Sincerely,



KENNETH E. BELIEU
Acting Secretary of the Army

1 Incl
As stated

COMMENTS OF THE OFFICE OF MANAGEMENT AND BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

16 March 1972

Honorable Robert F. Froehlke
Secretary of the Army
Washington, D. C. 20310

Dear Mr. Secretary:

Mr. Robert E. Jordan's letter of February 23, 1971, submitted the favorable report of the Chief of Engineers on North Shore of Long Island, Suffolk County, New York, requested by resolutions of the Committees on Public Works, United States Senate and House of Representatives, adopted March 20, 1963 and June 19, 1963, and in partial response to Public Law 71, 84th Congress, First Session, approved June 15, 1955.

You are advised that there would be no objection to the submission of the proposed report to the Congress. No commitment, however, can be made at this time as to when any estimate of appropriation would be submitted for construction of the project, if approved for appropriations, since this would be governed by the President's budgetary objectives as determined by the then prevailing fiscal situation.

Sincerely,

Donald B. Rice
Assistant Director

COMMENTS OF THE STATE OF NEW YORK

STATE OF NEW YORK
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
ALBANY

HENRY L. DIAMOND
COMMISSIONER

November 24, 1970

Dear General Clarke:

This Department has circulated the North Shore of Long Island, Suffolk County, New York Report among various interested State and local agencies for comments relative to PL 78-534 and PL 85-625 pertaining to water resources reports, and to PL 91-190 relative to your draft environmental statement.

We are in general agreement with that portion of the report pertaining to the recommended project's impact on the environment. We do, however, offer the following two comments relative to specific features of the project:

1. The Long Island State Park Commission feels that there is no need for groins within the beach area and requests that they not be included in the authorized project.

2. The jetty should be constructed to accommodate fishermen, with facilities to provide safe access, such as guard rails.

The report states that certain low-lying areas are subjected to tidal flooding, but protective works are not economically justified. Changing conditions, such as increased development in most of these areas, will warrant future consideration. We feel that review of these problem areas can be accomplished in accordance with Section 103 of the Rivers and Harbors Act of 1962.

The State of New York, in general, concurs with the recommendations of the Board of Engineers for Rivers and Harbors.

Sincerely,

Commissioner

Mr. F. J. Clarke
Lieutenant General, USA
Chief of Engineers
Office of the Chief of Engineers
U. S. Department of the Army
Washington, D. C. 20314

x

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

19 November 1970

Dear General Clarke:

This responds to your letter of August 7, 1970, asking for our comments on your proposed report and draft environmental statement on North Shore of Long Island, Suffolk County, New York.

We have reviewed the proposed report and draft statement and in general concur with your recommendations. We offer the following comments for your information and use.

The report indicates that the exact location of the fill borrow areas has not yet been specifically determined, other than they will be located in Smithtown Bay. When the areas are designated, the Director, Northeast Region, National Park Service, 143 S. Third Street, Philadelphia, Pennsylvania 19106, should be contacted in order to arrange for any necessary historical and archeological surveys and salvage.

To protect water quality during the construction period in accordance with provisions of Section 21(a) of the Federal Water Pollution Control Act, as amended, and Executive Order 11507, we recommend that contract specifications require all contractors and subcontractors to:

1. Exercise care in the relocation of any petroleum product pipelines and take precautions in the handling and storage of hazardous materials, such as petroleum, herbicides, and pesticides, to prevent accidental spillages or usage that would result in water pollution.

2. Provide and operate sanitary facilities to adequately treat and dispose of domestic wastes in conformance with Federal and State water pollution control regulations.

3. Perform all construction operations so that they will keep erosion, turbidity and siltation at the lowest level practicable.

We find that there is a need for recreational opportunity which the project would provide. Recreational use and benefits ascribed to the

project appear reasonable provided that adequate parking and bath-house facilities are made available. Recreational costs are not separately identified in the reports and it is not clear whether or not the plan of development adequately provides for necessary facility developments. The beach erosion control, rehabilitation of the recreational beaches, and jetty fishing opportunities which would result from this project are in accord with the objectives of the New York comprehensive outdoor recreation plan.

The project will have no permanent adverse effect on fish and wildlife resources.

While it is not imperative that the borrow areas be physically identified in this report, we feel that it is important that the potential problems associated with the dredging and pumping of the fill material be recognized in the Environmental Impact Statement. We therefore recommend that Section 3(b) of the Environmental Impact Statement be revised to include discussions of the following:

1. The effects of dredging one million cubic yards of fill material on the surrounding aquatic environment.

2. The expected quality of the fill material.

3. The probable effects of washwater runoff from the hydraulically filled beach.

4. Any other potential effects on the environment resulting from the proposed dredge and fill operation.

The draft environmental statement would also be improved by a discussion of past storm damage and the prospects for continued beach erosion in the future.

Sincerely yours,

Deputy Assistant Secretary of the Interior

Lt. Gen. F. J. Clarke
Chief of Engineers
Attn: ENGCW-PD
Department of the Army
Washington, D.C. 20314

COMMENTS OF THE DEPARTMENT OF TRANSPORTATION

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDANT (AWL)
U.S. COAST GUARD
WASHINGTON, D.C.
20591

27 August 1970

Lt. General F. J. Clarke
Chief of Engineers
Department of the Army
Washington, D. C. 20314

Dear General Clarke:

This is in response to your letter of 7 August 1970, addressed to Secretary Volpe, requesting comments on your proposed report concerning North Shore of Long Island, Suffolk County, New York.

The concerned operating administrations of the Department of Transportation have reviewed your proposed report, along with pertinent papers and concur in your recommendations for beach erosion control at Sunken Meadow State Park and Callahans Beach.

It is noted that the project will require the installation of a navigational light on the seaward end of the proposed stone jetty into Smithtown Bay at the Nissequoque River. The initial cost for this navigational light and its supporting structure is approximately $6,700.00 with an annual maintenance cost of $300.00. It is additionally noted that the proposed project for beach erosion control in the areas indicated is in agreement with the policy of the Water Resources Council as per the Water and Related Land Resources Planning policy statement of 22 July 1970.

The opportunity offered this Department to review and comment on your proposed report is appreciated.

Sincerely,

H. A. SOLBERG
Captain, U. S. Coast Guard
Acting Chief, Office of Public
and International Affairs

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

17 November 1970

Lt. General F. J. Clarke, USA
Chief of Engineers
U.S. Corps of Engineers
Department of the Army
Washington, D.C. 20315

Dear General Clarke:

As requested in your letter of August 7, 1970, the proposed report and draft environmental statement, together with pertinent papers, on "North Shore of Long Island, Suffolk County, New York," have been reviewed by the appropriate agencies of the Department that have an environmental interest.

The report describes a proposed project designed to restore and improve the beach of Sunken Meadow State Park, on the north shore of Long Island about 40 miles east-northeast of New York City. The proposal provides for artificial placement of beach fill pumped from offshore areas, with periodic nourishment of sand, and construction of a 560 foot terminal jetty at the Nissequogue River to hold the beach. This would reduce erosion of bluffs, stabilize the irrigation of the barrier bar, reduce loss of valuable park land, and accommodate a large portion of the growing recreational bathing demand.

Our review indicates that the project as proposed will have no significant adverse effect on the environmental factors of concern to the Department of Health, Education, and Welfare.

We recommend that appropriate health guidelines outlined in the following publications be employed during the development of this project:

1. For control of disease vector problems: Prevention and Control of Vector Problems Associated with Water Resources (Public Health Service monograph, January 1965).

2. For recreational areas: Environmental Health Practices in Recreational Areas (Public Health Service publication number 1195).

The Department of Health, Education, and Welfare has no objection to the authorization of this project insofar as Departmental interests and responsibilities are concerned.

Sincerely yours,

Roger O. Egeberg, M.D.
Assistant Secretary
for Health and Scientific Affairs

NORTH SHORE OF LONG ISLAND, SUFFOLK COUNTY, NEW YORK

REPORT OF THE CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

IN REPLY REFER TO

ENGCW-PD

3 December 1970

SUBJECT: North Shore of Long Island, Suffolk County, New York

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on a survey of the North Shore of Long Island, Suffolk County, New York, in the interest of beach erosion control and hurricane protection, in response to resolutions of the Committees on Public Works of the United States Senate and House of Representatives, adopted 20 March 1963 and 19 June 1963, respectively, and also in partial response to Public Law 71, Eighty-fourth Congress, first session, approved 15 June 1955. My report includes the reports of the District and Division Engineers and the Board of Engineers for Rivers and Harbors.

2. The District and Division Engineers report that erosion has caused a significant recession of the shoreline throughout most of the study area from Cold Spring Harbor to Orient Point and has reduced the effectiveness of the natural protective beaches. Wave action occurring during past hurricanes and storms has damaged shorefront developments. Also, several low-lying shore areas have been inundated by extremely high tides during these storms, causing flood damages to property and hardships to the residents. They find that improvements for hurricane protection are not economically justified. However, beach erosion control measures are economically justified at Caumsett, Wildwood, and Sunken Meadow State Parks, and at Callahans Beach. Local interests do not desire improvements considered for Caumsett and Wildwood State Parks at this time. Therefore, the District and Division Engineers recommend improvement for beach erosion control at Sunken Meadow State Park and Callahans Beach on the North Shore of Long Island in Suffolk County, New York, by provision of beach restoration and widening by artificial placement of approximately 1,000,000 cubic yards of beach fill along 2.6 miles of shorefront. The improvement includes construction

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of five groins, if needed, a jetty 560 feet long at the Nissequogue River with provisions on the jetty for recreational fishing, and periodic beach nourishment. The reporting officers estimate the total first cost of their plan at $4,392,000, exclusive of navigation aids estimated at $6,700. Annual charges are estimated at $349,500, based on an interest rate of 4.875 percent and a 50-year period of analysis, including $100,000 for periodic nourishment. Annual benefits are estimated at $707,600 and the benefit-cost ratio is 2.0. The first cost to the United States, exclusive of the cost of navigation aids, is estimated at $3,000,000. The annual cost to the United States for periodic nourishment for the initial 10-year period is estimated at $68,300.

3. The Board of Engineers for Rivers and Harbors concurs generally in the views and recommendations of the reporting officers. Accordingly, it recommends adoption of a project for beach erosion control on the North Shore of Long Island, Suffolk County, New York, at Sunken Meadow State Park, including the shore at Callahans Beach, generally as recommended by the reporting officers, subject to local cooperation, and with the added provision that if experience with periodic beach nourishment indicates the need and justification for construction of groins or other measures to reduce losses of beach fill, such measures, including initial fill, be provided under the discretionary authority of the Chief of Engineers in lieu of further Federal aid in periodic nourishment.

4. I concur in the views and recommendations of the Board. Use of the recently prescribed interest rate of 5-1/8 percent in computing annual charges and benefits would result in no appreciable change in the benefit-cost ratio.

F. J. CLARKE
Lieutenant General, USA
Chief of Engineers

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

IN REPLY REFER TO
ENGCW-PD

14 January 1971

SUMMARY
COORDINATION OF ENVIRONMENTAL STATEMENT
ON
NORTH SHORE OF LONG ISLAND, NEW YORK

1. Coordination of Environmental Statement.

AGENCY	Date of Transmittal	Date of Comments
Department of the Interior	7 Aug 70	19 Nov 70
Department of Transportation	7 Aug 70	27 Aug 70
Department of Health, Education and Welfare	7 Aug 70	17 Nov 70
State of New York	7 Aug 70	24 Nov 70

2. Summary of Agency Comments and Views of the Chief of Engineers:

The correspondence from the interested State and Federal agencies is attached as an inclosure to the environmental statement. The agency comments concerning the environmental aspects of the project are described below.

Department of the Interior.

Comment: The Department finds that the statement adequately describes the effects of the proposed project upon the environment. The Department states that when the fill borrow areas have been determined, the National Park Service should be contacted to arrange for any necessary historical and archaeological surveys and salvage. To protect water quality during the construction period the Department recommends three contract specifications. It also recommends that Section 3(b) of the Environmental Impact Statement be revised to include discussion of four items and that past storm damage and prospects for continued beach erosion also be discussed in the statement.

Department of Transportation.

Comment: The Department states that no comment is made concerning either the draft environmental statement or the environmental impact of the proposed project.

Department of Health, Education, and Welfare.

Comment: The Department states that the project as proposed will have no significant adverse effect on the environmental factors of concern to the Department. The Department recommends appropriate health guidelines outlined in three publications be employed.

State of New York.

Comment: The State of New York is in general agreement with that portion of the report pertaining to the recommended project's impact on the environment. It also offers the comments that the Long Island State Park Commission requests that groins not be included in the authorized project, and that the jetty should be constructed to accommodate fishermen.

7 August 1970

ENVIRONMENTAL STATEMENT
FOR
NORTH SHORE OF LONG ISLAND, NEW YORK

PREPARED IN CONNECTION WITH
A SURVEY REPORT OF THE
NEW YORK DISTRICT, CORPS OF ENGINEERS
NEW YORK CITY, NEW YORK

7 August 1970

NORTH SHORE OF LONG ISLAND IN SUFFOLK COUNTY, NEW YORK

ENVIRONMENTAL STATEMENT

1. Project Description. The proposed project is designed to restore and improve the beach of Sunken Meadow State Park, on the north shore of Long Island, about 40 miles eastnortheast of New York City. The shoreline has been eroding and the beach also has been damaged by tidal inundation during storms. To correct these problems it is proposed to widen and restore the beach by artificial placement of beach fill pumped from off shore areas, with periodic nourishment of sand, and to construct a 560 foot terminal jetty at the Nissequogue River to hold the beach. This would reduce erosion of bluffs, stabilize the migration of the barrier bar, reduce loss of valuable park land, and accommodate a large portion of the growing recreational bathing demand.

2. Environmental Setting Without the Project. The amount of this nation's coastline that is available for public beaches and in public ownership is limited and not deemed adequate to meet the needs of future generations. The beach of Sunken Meadow State Park is in public ownership and used extensively. Coastal storms have damaged this beach in recent years and if remedial action is not taken continued degradation and ultimate loss of the beach is expected.

3. Impact Statement. The following information is furnished in response to Section 102 (2)(c) of the National Environmental Policy Act of 1969.

a. Identify "the environmental impacts of the proposed action." The public beach will be restored and preserved for future generations and both scenic and utilitarian environmental values of this coastal area will be substantially enhanced for widespread public enjoyment.

b. Identify "any adverse environmental effects which cannot be avoided should the proposed plan be implemented." There are no known, lasting, adverse environmental impacts from implementing this beach restoration.

c. Identify "alternatives to the proposed action." The alternative to the proposed action is not to undertake the restoration and enhancement of the beach. This course of action would result in continued degradation of the shoreline and eventually a valuable beach would be lost. However, since studies leading to the recommended plan have not surfaced environmental conflicts there is no basis for giving the alternative any serious consideration.

d. Discuss "the relationship between local short term uses of man's environment and the maintenance and enhancement of long term productivity." Since there is no change in the use of project lands with or without this plan of improvement there will be no conflict between the local short term uses of man's environment and the maintenance and enhancement of the long term productivity of project lands. In fact this proposal is essential if the long term productivity of the existing public beach is to be preserved for future generations.

e. Identify "any irreversible and irretrievable commitment of resources which would be involved in the proposed action should it be implemented." The proposed plan merely provides for the restoration and preservation of one existing public beach for the present and future generations. The only known irreversible and irretrievable commitment of resources would be the commitment of labor and materials needed to construct the project.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

19 November 1970

Dear General Clarke:

This responds to your letter of August 7, 1970, asking for our comments on your proposed report and draft environmental statement on North Shore of Long Island, Suffolk County, New York.

We have reviewed the proposed report and draft statement and in general concur with your recommendations. We offer the following comments for your information and use.

The report indicates that the exact location of the fill borrow areas has not yet been specifically determined, other than they will be located in Smithtown Bay. When the areas are designated, the Director, Northeast Region, National Park Service, 143 S. Third Street, Philadelphia, Pennsylvania 19106, should be contacted in order to arrange for any necessary historical and archeological surveys and salvage.

To protect water quality during the construction period in accordance with provisions of Section 21(a) of the Federal Water Pollution Control Act, as amended, and Executive Order 11507, we recommend that contract specifications require all contractors and subcontractors to:

1. Exercise care in the relocation of any petroleum product pipelines and take precautions in the handling and storage of hazardous materials, such as petroleum, herbicides, and pesticides, to prevent accidental spillages or usage that would result in water pollution.

2. Provide and operate sanitary facilities to adequately treat and dispose of domestic wastes in conformance with Federal and State water pollution control regulations.

3. Perform all construction operations so that they will keep erosion, turbidity and siltation at the lowest level practicable.

We find that there is a need for recreational opportunity which the project would provide. Recreational use and benefits ascribed to the

project appear reasonable provided that adequate parking and bathhouse facilities are made available. Recreational costs are not separately identified in the reports and it is not clear whether or not the plan of development adequately provides for necessary facility developments. The beach erosion control, rehabilitation of the recreational beaches, and jetty fishing opportunities which would result from this project are in accord with the objectives of the New York comprehensive outdoor recreation plan.

The project will have no permanent adverse effect on fish and wildlife resources.

While it is not imperative that the borrow areas be physically identified in this report, we feel that it is important that the potential problems associated with the dredging and pumping of the fill material be recognized in the Environmental Impact Statement. We therefore recommend that Section 3(b) of the Environmental Impact Statement be revised to include discussions of the following:

1. The effects of dredging one million cubic yards of fill material on the surrounding aquatic environment.

2. The expected quality of the fill material.

3. The probable effects of washwater runoff from the hydraulically filled beach.

4. Any other potential effects on the environment resulting from the proposed dredge and fill operation.

The draft environmental statement would also be improved by a discussion of past storm damage and the prospects for continued beach erosion in the future.

Sincerely yours,

Deputy Assistant Secretary of the Interior

Lt. Gen. F. J. Clarke
Chief of Engineers
Attn: ENGCW-PD
Department of the Army
Washington, D.C. 20314

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDANT (AWL)
U.S. COAST GUARD
WASHINGTON, D.C.
20591

27 August 1970

Lt. General F. J. Clarke
Chief of Engineers
Department of the Army
Washington, D. C. 20314

Dear General Clarke:

This is in response to your letter of 7 August 1970, addressed to Secretary Volpe, requesting comments on your proposed report concerning North Shore of Long Island, Suffolk County, New York.

The concerned operating administrations of the Department of Transportation have reviewed your proposed report, along with pertinent papers and concur in your recommendations for beach erosion control at Sunken Meadow State Park and Callahans Beach.

It is noted that the project will require the installation of a navigational light on the seaward end of the proposed stone jetty into Smithtown Bay at the Nissequoque River. The initial cost for this navigational light and its supporting structure is approximately $6,700.00 with an annual maintenance cost of $300.00. It is additionally noted that the proposed project for beach erosion control in the areas indicated is in agreement with the policy of the Water Resources Council as per the Water and Related Land Resources Planning policy statement of 22 July 1970.

The opportunity offered this Department to review and comment on your proposed report is appreciated.

Sincerely,

H. A. SOLBERG
Captain, U. S. Coast Guard
Acting Chief, Office of Public
and International Affairs

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

17 November 1970

Lt. General F. J. Clarke, USA
Chief of Engineers
U.S. Corps of Engineers
Department of the Army
Washington, D.C. 20315

Dear General Clarke:

As requested in your letter of August 7, 1970, the proposed report and draft environmental statement, together with pertinent papers, on "North Shore of Long Island, Suffolk County, New York," have been reviewed by the appropriate agencies of the Department that have an environmental interest.

The report describes a proposed project designed to restore and improve the beach of Sunken Meadow State Park, on the north shore of Long Island about 40 miles east-northeast of New York City. The proposal provides for artificial placement of beach fill pumped from offshore areas, with periodic nourishment of sand, and construction of a 560 foot terminal jetty at the Nissequogue River to hold the beach. This would reduce erosion of bluffs, stabilize the irrigation of the barrier bar, reduce loss of valuable park land, and accommodate a large portion of the growing recreational bathing demand.

Our review indicates that the project as proposed will have no significant adverse effect on the environmental factors of concern to the Department of Health, Education, and Welfare.

We recommend that appropriate health guidelines outlined in the following publications be employed during the development of this project:

1. For control of disease vector problems: Prevention and Control of Vector Problems Associated with Water Resources (Public Health Service monograph, January 1965).

2. For recreational areas: Environmental Health Practices in Recreational Areas (Public Health Service publication number 1195).

The Department of Health, Education, and Welfare has no objection to the authorization of this project insofar as Departmental interests and responsibilities are concerned.

Sincerely yours,

Roger O. Egeberg, M.D.
Assistant Secretary
for Health and Scientific Affairs

STATE OF NEW YORK
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
ALBANY

HENRY L. DIAMOND
COMMISSIONER

November 24, 1970

Dear General Clarke:

This Department has circulated the North Shore of Long Island, Suffolk County, New York Report among various interested State and local agencies for comments relative to PL 78-534 and PL 85-625 pertaining to water resources reports, and to PL 91-190 relative to your draft environmental statement.

We are in general agreement with that portion of the report pertaining to the recommended project's impact on the environment. We do, however, offer the following two comments relative to specific features of the project:

1. The Long Island State Park Commission feels that there is no need for groins within the beach area and requests that they not be included in the authorized project.

2. The jetty should be constructed to accommodate fishermen, with facilities to provide safe access, such as guard rails.

The report states that certain low-lying areas are subjected to tidal flooding, but protective works are not economically justified. Changing conditions, such as increased development in most of these areas, will warrant future consideration. We feel that review of these problem areas can be accomplished in accordance with Section 103 of the Rivers and Harbors Act of 1962.

The State of New York, in general, concurs with the recommendations of the Board of Engineers for Rivers and Harbors.

Sincerely,

Commissioner

Mr. F. J. Clarke
Lieutenant General, USA
Chief of Engineers
Office of the Chief of Engineers
[illegible]

ENGBR (23 Jun 69) 2d Ind
SUBJECT: North Shore of Long Island in Suffolk County, New York, Beach Erosion Control and Interim Hurricane Study

Board of Engineers for Rivers and Harbors, Washington, D. C. 20315
18 June 1970

TO: Chief of Engineers, Department of the Army

1. The north shore of Long Island in Suffolk County, New York, extends about 87 miles from Cold Spring Harbor in the town of Huntington to Orient Point in the town of Southold, comprises about 75 percent of the total north shore of Long Island, and includes the towns of Huntington, Smithtown, Brookhaven, Riverhead, and Southold. Erosion has caused a significant recession of the shoreline throughout most of the area and has reduced the effectiveness of the protective beaches. Tidal inundation of low-lying shore areas during storms has caused extensive damage to property and hardships to the residents.

2. The adjacent terrain consists of rolling hills and flats rising to elevations of 200 feet above mean sea level and terminating at the shore in high bluffs, generally less than 200 feet in elevation, fronted by narrow beaches. West of Port Jefferson the shoreline is highly irregular, indented by many bays. East of Port Jefferson the shoreline is very regular with long gently curved reaches. The height of the bluffs becomes less in these reaches, decreasing from 150 feet near Port Jefferson to 100 feet north of Riverhead and to less than 50 feet near Orient Point. The mean tidal range along the shore varies from 7.4 feet at Cold Spring Harbor at the westerly limit of the study area to 2.5 feet at Plum Gut Harbor, near the easterly limit. Developments in the area are primarily residential and recreational in nature, with some commerce and industry. Residences along the shore range in size from large estates to small cottages, with the latter category predominating. The population of the study area was about 122,000 in 1966. Population projections indicate that the population will almost double by 1980. The real value of land and improvements in the five towns of the study area was $2,648,000,000 for the period 1965-1966. About 0.2 percent of the shore is Federally owned and about 18.4 percent is publicly owned.

3. There are no existing or authorized Federal projects for beach erosion control or hurricane protection in the study area. However, four Federal navigation projects serve the waterborne commerce in the area. Shallow-draft harbors are provided at Huntington, Northport, and Mattituck Harbors, and a deep-draft harbor is provided at Port Jefferson. Both private and public interests have constructed groins, jetties, seawalls, revetments, and bulkheads. In most cases, where properly maintained, these structures have served to provide protection against shore erosion and damage to shorefront development from wave attack, except during the most severe storms. The State of New York placed a total of about 840,000 cubic yards of hydraulic fill along the shore at Asharoken Beach in 1960 and 1964, and the Long Island State Park Commission placed 57,000 cubic yards of sand at Sunken Meadow State Park in 1957. Local interests are considering additional protective measures.

4. The shores are affected by waves generated by winds blowing across the limited fetches of Long Island Sound. No actual observations on wave heights in the study area are available. The sources of littoral material are the projecting headlands and high bluffs which are undergoing erosion. The predominant direction of littoral drift in the study area generally has been in a west-to-east direction, except at projecting headlands where the direction of littoral drift often is split along two directions. The shoreline has a general history of erosion, with only localized accretion and has been receding from about 1.0 to 3.5 feet per year.

5. Losses in the area result from inundation of low-lying areas by hurricane and storm tides and wave action. Between 1635 and 1962, inclusive, 231 hurricanes and other tropical and extratropical storms have occurred in the vicinity of the study area. Under existing conditions, eight of these storms would have caused severe damages, and 104 would have caused moderate to severe damage. The magnitude of flood damages experienced is indicated by the fact that the hurricane of 31 August 1954 (Hurricane Carol), which is the maximum storm of record, caused damages in excess of $700,000 in the study area. The maximum recorded tide level during this storm was 9.45 feet above mean sea level at Port Jefferson Harbor.

6. Local interests desire adequate protective measures to prevent losses from storms. They generally favor protection by beach fill; construction of groins, bulkheads, revetments, and seawalls; and artificial beach nourishment.

7. The District Engineer considered improvements for beach erosion control and hurricane protection at those locations which are affected most seriously and where there appeared to be sufficient public interest. He finds that the most practicable plan of improvement in the area under study would provide for shore protection at Sunken Meadow State Park, New York, including the adjacent shore at Callahans Beach. The plan would consist of beach restoration and widening by artificial placement of approximately 1,000,000 cubic yards of beach fill along 2.6 miles of shorefront with a berm at an elevation of 13.0 feet above mean low water and a berm width of 100 feet along the easterly 2,250 feet of the shore, thence a width of 150 feet in the central 5,900 feet of shore generally fronting the boardwalk area, and thence a width of 100 feet along the westerly 5,300 feet of shore fronting the bluff area, as shown on Plate 41 of the District Engineer's report. The project includes construction of a stone jetty 560 feet long at the Nissequogue River; construction of five groins, if needed, to hold the restored beach; and appurtenant works on the jetty for recreational fishing.

8. Shore protection plans also were developed for Caumsett State Park in Huntington, New York, and for Wildwood State Park in Riverhead, New York, and were found to be economically justified. However, local interests have indicated that they do not desire improvements at this time pending further increases in recreational demands. Improvements for hurricane protection were considered for Asharoken Beach and Port Jefferson Harbor, but were found to be economically not justified.

9. The District Engineer estimates the first cost of his plan, based on March 1969 prices, at $4,392,000, exclusive of the cost of preauthorization studies of $177,000 and cost of aids to navigation estimated at $6,700, both of which are Federal costs. He estimates the annual charges, based on an interest rate of 4-5/8 percent and a 50-year period of analysis, at $340,400, of which $100,000 is the estimated annual cost of periodic nourishment and $300 is for maintenance of aids to navigation. The annual benefits are estimated at $707,600, resulting in a benefit-cost ratio of 2.1. The District Engineer recommends adoption of his plan, subject to certain conditions of local cooperation.

10. The Division Engineer notes that application of the current interest rate of 4-7/8 percent results in annual charges of $349,500, with annual benefits remaining at $707,600, and a benefit-cost ratio of 2.0. He concurs in general with the recommendations of the District Engineer. However, he expresses doubt that the five groins proposed will be needed and recommends that if they are constructed, they be built incrementally to eliminate the possibility of starving the downdrift beach.

11. The Division Engineer issued a public notice stating the recommendations of the reporting officers and affording interested parties an opportunity to present additional information to the Board. Careful consideration has been given to the communications received.

Views and Recommendations of the Board of Engineers for Rivers and Harbors.

12. Views.--The Board of Engineers for Rivers and Harbors concurs in general in the views and recommendations of the reporting officers. The Board believes that the proposed improvements are economically justified and the conditions of local cooperation are appropriate.

13. Recommendations.--Accordingly, the Board recommends adoption of a project by the United States for beach erosion control on the North Shore of Long Island, Suffolk County, New York, at Sunken Meadow State Park, including the shore at Callahans Beach, providing for:

> Beach restoration and widening by artificial placement of approximately 1,000,000 cubic yards of beach fill along 2.6 miles of shorefront, with a berm at elevation 13.0 feet above mean low water and a berm width of 100 feet along the easterly 2,250 feet of shore, thence a width of 150 feet in the central 5,900 feet of shore generally fronting the boardwalk area, and thence a width of 100 feet along the westerly 5,300 feet of shore fronting the bluff area;
>
> Construction of a jetty, 560 feet long, at the mouth of the Nissequogue River;
>
> Construction of five groins, if needed, to hold the restored beach;

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Provision of appurtenant works on the jetty for recreational fishing; and

Performance of periodic nourishment of the restored beach limited initally to a period of 10 years;

all generally in accordance with the plan of the District Engineer and with such modifications thereof as in the discretion of the Chief of Engineers may be advisable, at an estimated cost to the United States of $3,000,000 (68.3 percent of the total first costs exclusive of navigation aids) and an annual cost of $68,300 for periodic beach nourishment (68.3 percent of the periodic beach nourishment cost): Provided that, prior to initiation of construction, local interests furnish assurances satisfactory to the Secretary of the Army that they will:

a. Contribute in cash 31.7 percent of the total first cost, a sum presently estimated at $1,392,000, to be paid in a lump sum prior to start of construction, or in installments prior to start of pertinent work items in accordance with construction schedules as required by the Chief of Engineers, the final apportionment of costs to be made after actual costs have been determined and based on the conditions of public use and ownership at the time of construction;

b. Provide without cost to the United States all lands, easements, and rights-of-way, including borrow areas, and relocations required for construction and subsequent nourishment of the project;

c. Hold and save the United States free from damages due to the initial construction and periodic nourishment;

d. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army and provide periodic nourishment during the economic life of the shore protection works as may be required to serve the intended purpose with Federal participation in the cost of periodic nourishment for an initial period of 10 years; the non-Federal share of nourishment costs for the 10-year period is presently estimated at $31,700 annually (31.7 percent of the cost of the nourishment);

e. Maintain during the economic life of the improvement continued public ownership and use of the non-Federal publicly owned shores upon which the Federal participation in beach protection is based;

f. Control water pollution to the extent necessary to safeguard the health of bathers;

g. Provide without cost to the United States the facilities necessary to realize the benefits evaluated for the considered improvement; and

h. Maintain the publicly owned park throughout the life of the project in such a manner that it would qualify for 70 percent Federal participation in accordance with provisions of Public Law 87-874;

and provided further that if experience with periodic beach nourishment indicates the need and justification for construction of groins or other measures to reduce losses of beach fill, such measures, including initial fill, be provided under the discretionary authority of the Chief of Engineers in lieu of further Federal aid in periodic nourishment.

FOR THE BOARD:

C. H. DUNN
Major General, USA
Chairman

REPORT OF THE DISTRICT ENGINEER

NORTH SHORE OF LONG ISLAND IN SUFFOLK COUNTY, NEW YORK
BEACH EROSION CONTROL AND INTERIM HURRICANE STUDY

S Y L L A B U S

The purpose of this study is to determine the most practicable and economic plan of restoring and maintaining adequate recreational and protective beaches, and to develop plans of protection against hurricane tidal flooding along the north shore of Suffolk County, New York on Long Island Sound.

The District Engineer considered a shore protection improvement at Sunken Meadow State Park in Smithtown, New York. The improvement provides for beach fill on 13,450 feet of shorefront, a jetty, five groins, if experience indicates a need, and periodic sand nourishment. The total first cost is estimated at $4,392,000 of which $3,000,000 is a Federal cost. The annual cost of periodic beach nourishment is estimated at $100,000 of which $68,300 is a Federal cost. The annual charges for this improvement would be $340,400, and the annual benefits would be $707,600, for a benefit cost ratio of 2.1 to 1.0.

The District Engineer finds that construction of works for protection of low-lying areas at Asharoken Beach and Port Jefferson Harbor against tidal flood inundation is not economically justified. To minimize future flood damages and avoid loss of life during severe storms and hurricanes, local interests should control development within the flood plain area and have an adequate storm warning system and evacuation plans.

The District Engineer suggests plans of improvement and corrective measures for possible local implementation in other problem areas where Federal participation could not be justified.

The District Engineer, therefore, recommends adoption of the considered improvement at Sunken Meadow State Park at Smithtown as a Federal project at a first cost to the United States presently estimated at $3,000,000 (68.3 percent of the total first cost of the project) plus $68,300 annually for periodic beach nourishment for a period not to exceed 10 years after completion of the initial work in order to permit reevaluation.

Federal participation in the recommended improvement would be subject to the conditions that local interests: provide without cost to the United States all lands, easements, and rights-of-way; hold and save the United States free from damages due to the construction works; bear 31.7 percent of the total first cost; maintain and operate all the work after completion and provide 31.7 percent of the cost of periodic nourishment for an initial period of 10 years; maintain during the economic life of the project continued public ownership and use of the non-Federal publicly-owned shores; control water pollution to the extent necessary to safeguard the health of bathers; provide at its own cost the facilities necessary to realize benefits evaluated for the recommended improvement; and maintain the park to qualify for 70 percent Federal participation.

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
26 FEDERAL PLAZA
NEW YORK, N.Y. 10007

NANEN-Be 23 June 1969

SUBJECT: North Shore of Long Island in Suffolk County, New York
Beach Erosion Control and Interim Hurricane Study

Division Engineer
North Atlantic Division, Corps of Engineers
New York, New York

I. INTRODUCTION

1. AUTHORITIES. The subject report is a combined report of beach erosion control and hurricane protection studies. The authorizations for these studies are contained in the following paragraphs.

2. Hurricane study. The hurricane study was authorized by Public Law 71, 84th Congress, 1st Session, approved 15 June 1955, which reads:

> "Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That: In view of the severe damage to the coastal and tidal areas of the eastern and southern United States from the occurrence of hurricanes, particularly the hurricanes of August 31, 1954, and September 11, 1954, in the New England, New York, and New Jersey coastal and tidal areas, and the hurricane of October 15, 1954, in the coastal and tidal areas extending south to South Carolina, and in view of the damages caused by other hurricanes in the past, the Secretary of the Army, in cooperation with the Secretary of Commerce and other Federal agencies concerned with hurricanes, is hereby authorized and directed to cause an examination and survey to be made of the eastern and southern seaboard of the United States with respect to hurricanes, with particular reference to areas where severe damages have occurred.
>
> "Sec. 2. Such survey, to be made under the direction of the Chief of Engineers, shall include the securing of data on the behavior and frequency of hurricanes, and the determination of methods of forecasting their paths and improving warning services, and of possible means of preventing loss of human lives and damages to property, with due consideration of the economics of proposed breakwaters, seawalls, dikes, dams, and other structures, warning services, or other measures which might be required."

3. Beach erosion study. The beach erosion control study was authorized by the following two Congressional resolutions.

Resolution of 20 March 1963:

"Resolved by the Committee on Public Works of the United States Senate, That in accordance with Section 110 of the River and Harbor Act, approved October 23, 1962, the Secretary of the Army be, and is hereby requested to cause to be made, under the direction of the Chief of Engineers, a survey of the north shore of Long Island in Suffolk County, New York, and such adjacent shores as may be necessary, in the interest of beach erosion control, hurricane protection, and related purposes."

Resolution of 19 June 1963:

"Resolved by the Committee on Public Works of the House of Representatives, United States, That in accordance with Section 110 of the River and Harbor Act, approved October 23, 1962, that the Secretary of the Army be, and is hereby requested to cause to be made, under the direction of the Chief of Engineers, a survey of the north shore of Long Island in Suffolk County, New York, and such adjacent shores as may be necessary, in the interest of beach erosion control, hurricane protection and related purposes."

4. Combined study. Approval was granted by the Chief of Engineers, U.S. Army, on 20 June 1963, to prepare a combined report to include both the beach erosion control and hurricane protection studies.

II. PURPOSE AND SCOPE

5. BEACH EROSION STUDY PURPOSE. The purpose of the beach erosion control phase of this survey is to determine the best method of restoring adequate recreational and protective beaches and stabilizing the bluffs within the subject area. The beach erosion study as well as the hurricane study covers the north shore of Long Island in Suffolk County from Cold Spring Harbor eastward to Orient Point.

6. HURRICANE STUDY PURPOSE. The purpose of the hurricane study phase is to develop data on hurricanes and adequate measures of protection against hurricane tidal flooding of low-lying areas within the subject area. While the hurricane study phase is complete in itself for this area, it is an interim study as one of a series in preparation which, when completed, will cover other coastal areas as authorized by Public Law 71, 84th Congress.

7. SCOPE. In the preparation of this report, extensive basic data were collected and analyzed. Field data consisting of hydrographic and topographic surveys, samples of beach and bottom materials, a survey of existing protective shore structures, and aerial photography were obtained

during the period covering the years 1964 to 1966. Storm damage surveys were made in the study area in 1956. The part of the damage survey in the Port Jefferson area was updated and supplemented in 1964. In addition, pertinent data was furnished by other Federal agencies and by State, county, town and village officials. Office work consisted of analysis of data pertinent to both the hurricane and beach erosion problems. Various engineering and special studies were also carried out. Designs and cost estimates were prepared and economic analyses were made of the plans of protection considered.

III. PRIOR REPORTS

8. HURRICANE AND BEACH EROSION REPORTS. There have been no prior reports dealing specifically with beach erosion control or hurricane protection in the study area. A general inventory of beach erosion problems and navigation facilities on Long Island was presented by the New England-New York Inter-Agency Committee in "Navigation and Beach Erosion in Long Island, New York" as Part Two, Chapter XXXVIII of "The Resources of the New England-New York Region". Data and information on the characteristics and effects of hurricanes on the Long Island area are presented in Part Two, Chapter XXXIX of the same report.

9. Prior reports which have been made by the Corps of Engineers on beach erosion control and/or hurricane studies of shore areas in the proximity of the study area, are listed in table 1. These reports include beach erosion and hurricane studies made by the New England Division, Corps of Engineers, on the north side of Long Island Sound along the coastal area of the State of Connecticut. They also include reports on such studies made by the New York District along the shore of Westchester County, New York and along the south shore of Long Island in Nassau and Suffolk Counties from Jones Inlet to Montauk Point, New York. A beach erosion and hurricane study is currently being conducted by the New York District along the shore area from Jones Inlet to East Rockaway Inlet.

10. NAVIGATION REPORTS. There are a number of reports on navigation studies along the north shore of Suffolk County which have been made by the Corps of Engineers. The reports which have been the basis for authorized projects at Huntington, Northport, Port Jefferson and Mattituck Harbors and the resulting improvements are listed in table 2.

IV. DESCRIPTION

11. GENERAL. The study area consists of that portion of the north shore of Long Island in Suffolk County, New York, extending from Cold Spring Harbor in the town of Huntington to Orient Point in the town of Southold. The shoreline of the study area is about 87 miles in length and comprises about 75 percent of the total frontage of the north shore of the island along Long Island Sound. The westerly limit of the study area is about 40 miles by highway from New York City. There are 45 villages along the shore of the study area in five towns of Suffolk County. A listing of these communities is given geographically from west to east in table 3.

TABLE 1 - PRIOR BEACH EROSION CONTROL AND HURRICANE REPORTS

Report	Authorizing Document	Year	Description of Existing Project
	Interim Hurricane Survey Reports		
Westchester County, New York along Long Island Sound	House Document No. 190, 90th Congress, 1st Session	1967	No project considered for Federal participation.
Stamford, Connecticut	House Document No. 210, 86th Congress, 1st Session	1959	Adopted by Flood Control Act of 14 July 1960. Hurricane protection project provides for barrier across East Branch, near its mouth, with a gated opening for navigation and dike extensions, dike and wall protection on east bank of West Branch, and dike protection in Westcott Cove, Cummings Park area of city. Project construction generally completed.
Westport, Connecticut	House Document No. 412, 87th Congress, 2d Session	1962	Adopted by Flood Control Act of 23 October 1962. Hurricane protection project provides for construction of dike for the residential area of the Compo Beach section of Westport. Project was placed in an inactive status on 8 April 1965 because of lack of local cooperation. Project authority expires 18 February 1970.
Fairfield, Connecticut	House Document No. 600, 87th Congress, 2d Session	1962	Plan of protection considered but not recommended in accordance with desires of local interests.
Stratford, Connecticut	House Document No. 292, 88th Congress, 2d Session	1964	Adopted by Flood Control Act of 27 October 1965. Hurricane project provides for construction of the following: dikes around the greater part of flooded area in the Great Meadows section; dikes and floodwalls along and inshore of west bank of lower Housatonic River and shoreline of Long Island Sound, north of Stratford Point; and pumping stations and appurtenant works. Advance engineering on the project is underway. Planning is expected to be completed in Fiscal Year 1970.
New London, Connecticut	House Document No. 478, 87th Congress, 2d Session	1962	Adopted by Flood Control Act of 23 October 1962. Hurricane protection project provides for barriers with gated navigation openings and pumping stations to protect the Bentleys Creek and Shaw Cove areas of New London. Advance engineering of project underway. Project planning expected to be completed early in 1970.
Mystic, Connecticut	House Document No. 411, 87th Congress, 2d Session	1962	Adopted by Flood Control Act of 23 October 1962. Hurricane protection project provides for construction of gated barrier across the entrances to Mystic Harbor. Project was placed in an inactive status on 17 November 1967 because of lack of local cooperation. Project authority expires 14 August 1972.

TABLE 1 - PRIOR BEACH EROSION CONTROL AND HURRICANE REPORTS (Cont'd)

Report	Authorizing Document	Year	Description of Existing Project
		Interim Hurricane Survey Reports (Cont'd)	
Pawcatuck, Connecticut	House Document No. 212, 86th Congress, 1st Session	1959	Adopted by Flood Control Act of 14 July 1960. Hurricane local protection project provides for construction of dike and accessory works in one section of Pawcatuck. Construction of the project is completed.
Connecticut Coastal and Tidal Areas	House Document No. 146, 89th Congress, 1st Session	1965	Summary report summarizing results of hurricane studies of State coastal and tidal areas, and status of hurricane program as of 22 May 1964 in State of Connecticut. Presents considered plans of protection for remaining areas in Connecticut not covered in other reports.
Jones Inlet to Montauk Point, New York (Remaining Areas)	House Document No. 191, 90th Congress, 1st Session		No project considered for Federal participation.
		Beach Erosion Control Reports	
Areas 8 and 11, Saugatuck River to Byram River, Connecticut	House Document No. 174, 85th Congress, 1st Session	1957	Adopted by River and Harbor Act of 3 July 1958. Four beach widening and groin construction projects at Calf Pasture Beach, Norwalk, Cove Island and Cummings Park in Stamford, and Greenwich Point in Greenwich. Projects at Calf Pasture Beach, Cove Island and Cummings Park are completed. No work has been initiated at Greenwich Point.
Area 1, Ash Creek to Saugatuck River, Connecticut	House Document No. 454, 81st Congress, 2d Session	1950	Adopted by River and Harbor Act of 17 May 1950. Six beach widening and groin construction projects at Jennings, Sasco Hill and Southport Beaches in Fairfield, and at Burial Hill, Sherwood Island and Compo Beaches in Westport. All projects are completed.
Area 7, Housatonic River to Ash Creek, Connecticut	House Document No. 248, 83rd Congress, 2d Session	1953	Adopted by River and Harbor Act of 3 September 1954. Two beach widening projects at Short Beach, Stratford and at Seaside Park, Bridgeport. Both projects are completed.
Area 3, New Haven Harbor to Housatonic River, Connecticut	House Document No. 203, 83rd Congress, 1st Session	1953	Adopted by River and Harbor Act of 3 September 1954. Four beach widening and groin construction projects: Gulf Beach, Silver Beach to Cedar Beach and Woodmont Shore in Milford; and Prospect Beach in West Haven. All projects completed except at Silver Beach to Cedar Beach which has been initiated.
Area 9, East River to New Haven Harbor, Connecticut	House Document No. 395, 84th Congress, 2d Session	1957	Adopted by River and Harbor Act of 3 July 1958. Two groin construction projects at Lighthouse Point Park in New Haven and at Guilford Point Beach in Guilford. Both projects are completed.

TABLE 1 - PRIOR BEACH EROSION CONTROL AND HURRICANE REPORTS (Cont'd)

Report	Authorizing Document	Year	Description of Existing Project
	Beach Erosion Control Reports (Cont'd)		
Area 2, Hammonasset River to East River, Connecticut	House Document No. 474, 81st Congress, 2d Session	1950	Adopted by River and Harbor Act of 3 September 1954. Two projects in Madison: beach widening and groin construction at Hammonasset Beach; and revetment construction at Middle Beach. Both projects are completed.
Area 4, Connecticut River to Hammonasset River, Connecticut	House Document No. 514, 82d Congress, 2d Session	1952	No project recommended for Federal participation.
Area 6, Niantic Bay to Connecticut River, Connecticut	House Document No. 84, 83rd Congress, 1st Session	1953	No project recommended for Federal participation.
Area 10, Thames River to Niantic Bay, Connecticut	House Document No. 334, 85th Congress, 2d Session	1957	No project recommended for Federal participation.
Area 5, Pawcatuck River to Thames River, Connecticut	House Document No. 31, 83rd Congress, 1st Session	1952	No project recommended for Federal participation.
Fire Island Inlet to Jones Inlet, New York	House Document No. 411, 84th Congress, 2d Session	1956	Adopted by River and Harbor Act of 3 July 1958 and modified by River and Harbor Act of 23 October 1962. Project provided for dredging Fire Island Inlet, establishing a feeder beach, and constructing a closure dike. Two incremental dredging and beach fill operations were completed in June 1960 and November 1964.
Fire Island Inlet to Jones Inlet, New York	House Document No. 115, 89th Congress, 1st Session	1965	Plans for authorized modification of existing project approved on 20 February 1965 to provide for combining beach erosion control and navigation improvements to include a littoral reservoir, navigation channel, deposition reservoir, dikes, jetty extension, and periodic transfer of littoral drift to feeder beach.
	Beach Erosion Control and Hurricane Reports		
Fire Island Inlet to Montauk Point, New York	House Document No. 425, 86th Congress, 2d Session	1960	Adopted by River and Harbor Act of 14 July 1960. Project provides for beach widening, construction of dunes, interior drainage structures, groins, and periodic nourishment along five reaches of shore. Construction of 11 groins at Westhampton Beach and two groins at East Hampton Beach has been completed. Planning is underway in several other sections of the project.

TABLE 2 - PRIOR REPORTS ON EXISTING FEDERAL NAVIGATION PROJECTS

Report	Authorizing Document	Year	Description of Existing Project
Huntington Harbor, N. Y.	H. Doc. No. 200, 48th Cong., 2d Sess. H. Doc. No. 638, 75th Cong., 3d Sess.	1885 1938	Adopted 1890, modified 1938. Provides for: (a) a main channel 8 feet deep and 100 feet wide for a length of 2.2 miles with a turning basin 200 feet wide, thence 6 feet deep and 100 feet wide for a length of 0.2 mile; (b) an anchorage 6 feet deep and 14 acres in extent at the end of the main channel; and (c) a cross channel 8 feet deep and 100 feet wide, extending 0.4 mile from the main channel. The project is 52 percent complete.
Northport Harbor, N. Y.	H. Doc. No. 109, 76th Cong., 1st Sess.	1938	Adopted 1945. Provides for: (a) a channel 8 feet deep, 100 feet wide and about 0.4 mile long; and (b) an anchorage basin 6 feet deep and 15 acres in extent. Project is complete.
Port Jefferson Harbor, N. Y.	Annual Report of Chief of Engineers, 1889, p. 751 Annual Report of Chief of Engineers, 1895, p. 831 H. Doc. No. 305, 75th Cong., 1st Sess.	1889 1895 1928	Adopted 1890, modified in 1894 and 1930. Provides for: (a) a channel through the harbor entrance, 16 feet deep, 300 feet wide, and about 0.6 mile long; (b) repair and enlargement of the two riprap jetties constructed under the previous project; and (c) the extension of the east jetty for 450 feet. Length of the west jetty is 940 feet and the projected length of the east jetty is 1,900 feet. Project is 30 percent complete. The channel has been dredged to the 26-foot depth by private interests for a distance of about 2.0 miles to the inner harbor.
	H. Doc. No. 277, 90th Cong., 2d Sess.	1967	Recommended a modification of the existing project to include a channel 40 feet deep at mean low water and 350 feet wide from deep water in Long Island Sound to the head of the harbor, a distance of about 2.3 miles, and a turning basin near the inshore end of the channel 30 feet deep at mean low water, 700 feet wide and 1,400 feet long.
Mattituck Harbor, N. Y.	Annual Report of Chief of Engineers, 1891, p. 843 H. Doc. No. 8, 71st Cong., 1st Sess.	1891	Adopted 1896, modified 1935. Provides for: (a) a channel 7 feet deep at mean low water with a width of 100 feet at the entrance and 80 feet inside the harbor for a total length of 1.0 mile, thence 7 feet deep at mean high water and 80 feet wide for a total length of 1.2 miles; and (b) two riprap jetties at the entrance. The above work have been completed. Under authority of Section 107 of the River and Harbor Act of 1960, modification of the existing project was formally approved on 11 August 1964, to provide for a channel 7 feet deep at mean low water, 80 feet wide, and 1.1 miles long long instead of the 7-foot mean high water channel, and for a 460 by 570-foot anchorage area of the same depth at the upper end. No work has been performed on this modification.

12. Published maps of the study area are: U. S. Coast and Geodetic Survey Chart Nos. 1211, 1212, 1213, 224, 361, 362, and 363, scales 1:10,000 to 1:80,000; and the U. S. Geological Survey quadrangles of Lloyd Harbor, Huntington, Northport, Saint James, Port Jefferson, Middle Island, Wading River, Riverhead, Mattituck, Mattituck Hills, Southold, Greenport, Orient, and Plum Island, New York, scale of 1:24,000. Other maps, published by the Army Map Service, are the New York and Providence sheets, scale of 1:250,000. Plates 1 to 14 and photos 1 to 58 accompanying this report also show the study area.

13. The terrain of the study area consists of rolling hills and flats rising to elevations of up to 200 feet above mean sea level and terminating at the shore with high bluffs, generally less than 200 feet above mean sea level, fronted by narrow beaches. West of Port Jefferson, the shoreline is highly irregular, being indented by many bays. East of Port Jefferson, the shoreline is very regular, being made up of long gently curved reaches. In these reaches, the elevation of the bluffs above mean sea level becomes less, decreasing from 150 feet near Port Jefferson to 100 feet north of Riverhead, and to less than 50 feet near Orient Point.

14. POPULATION. The shore of the study area borders 11 incorporated villages and 34 unincorporated villages in five towns of Suffolk County, which had a total population of 95,877 in 1960, as determined by the U.S. Bureau of the Census. The population of Suffolk County during the same census, was 666,784. This population represents an increase of 238 percent over the 1940 population of 197,355. The Long Island Lighting Company, which provides electric power in Suffolk County, estimates that at the beginning of 1966 this population had increased to 938,846. Population projections of the Office of Business Economics (OBE) indicate that by 1980 Suffolk County will have a population of almost 1.5 million people. On this basis the population in the study area will have increased to about 215,000 people in 1980. Tabulations of past populations for various years are given in table 3 for individual villages in the study area, and in table 4 for Suffolk and Nassau Counties, New York City Region, and Planning Area 0114. Population projections to 2020 are given in table 5.

15. SHORE DEVELOPMENT AND ACTIVITIES. In the study area, shore development is primarily residential and recreational in character with some commerce and industry. Residences along the shore vary in size from large estates to small cottages, with the latter category being found in preponderance. With the exception of the concentrated low-lying development around harbor areas, residences bordering the shore are found primarily on the top of high bluffs and secondarily on the backshores of beaches and barrier bars. Commercial and industrial development is found generally in the vicinity of harbor areas or seats of local governments. The only Federally-owned lands bordering the shore of the study area are at the Eatons Neck Coast Guard Station in the town of Huntington, at Old Field Point in the town of Brookhaven and at Hortons Point in the town of Southold. A navigation beacon is in operation at each location. The Federal lands comprise approximately 0.2 percent of the total length of shore in the study area.

TABLE 3 - POPULATION OF COMMUNITIES IN THE STUDY AREA, 1960 AND 1966

Town	Village	Population 1960[a]	Population 1966[b]
Huntington			
	Cold Spring Harbor	1,705	1,992
	Lloyd Harbor, Inc.	2,521	3,153
	Huntington	11,255	12,524
	Halesite	2,857	2,965
	Huntington Bay, Inc.	1,267	1,557
	East Neck	3,789	4,753
	Centerport	3,628	4,738
	Greenlawn	5,422	6,618
	East Greenlawn	912	1,170
	Northport, Inc.	5,972	6,819
	Asharoken, Inc.	253	410
	Great Neck[c]) Eatons Neck) Northport Veteran Hospital)	5,598	7,200
	Total-Huntington	45,179	53,900
Smithtown			
	Fort Salonga	1,820	2,178
	Kings Park	13,785	15,878
	San Remo	3,160	7,663
	North Smithtown	2,561	4,126
	Nissequogue, Inc.	332	621
	Head of the Harbor, Inc.	524	776
	Total-Smithtown	22,182	31,242
Brookhaven			
	Stony Brook	3,548	4,700
	Old Field, Inc.	373	580
	Setauket	1,207	1,477
	East Setauket	1,127	1,005
	Poquott, Inc.	295	384
	Port Jefferson, Inc.	2,336	4,459
	Belle Terre, Inc.	295	441
	Mount Sinai	875	331
	Miller Place	1,230	1,711
	Sound Beach	1,625	2,092
	Rocky Point	2,234	2,910
	Shoreham, Inc.	164	239
	North Middle Island-Ridge Area	1,509	2,009
	Total-Brookhaven	16,818	22,338
Riverhead			
	Wading River	645	796
	Wildwood	471	593
	Baiting Hollow	140	143
	Roanoke	1,413	1,872
	Northville	2,022	2,444
	Total-Riverhead	4,691	5,848
Southold			
	Laurel	999	1,159
	Mattituck	1,274	1,549
	North Mattituck	662	775
	Peconic-Nassau Point	976	1,196
	North Southold	874	1,063
	Greenport	980	1,121
	East Marion	637	707
	Orient Point	605	635
	Total-Southold	7,007	8,205
	Total-Study Area	95,877	121,533

(a) Based on U.S. Bureau of the Census statistics.

(b) Based on estimates of Long Island Lighting Company.

(c) Fort Salonga section of Northport.

TABLE 4 - PAST POPULATION

Region	Past Population by Years in Thousands				Percent increase 1940-1960
	1940	1950	1960	1966(c)	
Planning Area 0114(a)	12,095	13,497	15,485	-	28
New York City Region(b)	8,059	8,840	9,749	-	21
Nassau County	407	672	1,300	1,410	219
Suffolk County	197	276	667	939	238

(a) New York City Water Resources Planning Area 0114 includes Bergen, Essex, Hudson Middlesex, Monmouth, Morris, Passaic, Somerset and Union Counties in New Jersey; and Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk and Westchester Counties in New York.

(b) Includes Bronx, Kings, New York, Queens, Richmond, Nassau and Suffolk Counties in New York.

(c) Based on estimates of Long Island Lighting Company.

TABLE 5 - PROJECTED POPULATION, 1960-2020

Region	Projected Population by Years in Thousands				
	1960	1970	1980	2000	2020
Planning Area 0114(a)	15,485	17,141	18,905	22,925	27,533
New York City Region(b)	9,749	10,373	10,997	12,819	14,772
Nassau County	1,300	1,423	1,542	1,779	2,068
Suffolk County	667	1,036	1,499	1,972	2,542

(a) See footnote (a) in table 4.

(b) See footnote (b) in table 4.

16. The study area is well known for its recreational development which is found in the form of State parks, numerous public and private beaches and marina facilities for recreational fleets at several locations. Sunken Meadow State Park, operated by the Long Island State Park Commission, offers for public use the largest single bathing beach in the study area, and in 1966 had a total annual attendance of 1,769,500 people. Wildwood State Park near Wading River, offers camping and trailer areas for public use as well as an excellent beach. Caumsett State Park on Lloyd Neck, as yet undeveloped, will aid in serving future recreational needs. An example of the demand for recreational facilities is shown by the recent construction of marinas at Mount Sinai Harbor by a group of private citizens.

17. The economy of Suffolk County is sustained primarily by manufacturing industries and secondarily by agriculture. In 1954, agricultural products totaling $37,761,000 in value formed about 10 percent of the total value of all goods produced, which was $382,700,000.* Aircraft, electronics, machined and fabricated metal products, building materials, women's apparel, and food processing are typical examples of the manufacturing industry. The agricultural activity consists of potato and vegetable farming and duck farming, which is concentrated in the southern part of the county. Within the study area itself, industrial development is found in varying degrees around Cold Spring, Huntington, Northport, Port Jefferson, and Mount Sinai Harbors and at Mattituck Inlet. Much of this development is for the purpose of transferring and storing of oil and petroleum products and sand and gravel, and of accommodating commercial finfishing and shellfishing equipment and products. At Northport the Long Island Lighting Company has constructed an offshore oil transfer facility for deep draft tankers to provide fuel for its new electric power generation plant. At Jacobs Point in Northville, there is another offshore facility for such vessels to transfer fuel oil to a tank farm located on the shore. However, the harbor at Port Jefferson is the only one in the study area which can accommodate deep draft vessels, while barges or small vessels can be handled in the other waterways (table 2). It is noted that the extraction and transfer of sand and gravel from natural deposits along the shore of the study area forms an important part of the economy of this area.

18. TRANSPORTATION. The study area is served by various means of public transportation including railroad, highway, rapid-transit, ferry and airport facilities. The land transportation links to Suffolk County travel in a west to east direction and consist of rail and vehicular routes. The Long Island Railroad provides excellent service and maintains three lines to different parts of the county, two of which serve the study area. A branch line to the western part of the north shore services the towns of Huntington and Smithtown and terminates at Port Jefferson in the town of Brookhaven. The main line runs through the longitudinal center of the county to Riverhead and then through the north fork to Greenport in the eastern section of the study area. Other sections of the study area are

*From "Statistical Abstract of Nassau and Suffolk Counties, Long Island, N.Y." Published by Franklin National Bank of Long Island, 1962.

generally less than 10 miles from most railroad stations on these lines. A third line serves the entire south shore to Montauk. Various bus lines provide local service to centers of population not served by the railroad.

19. Suffolk County is served by several major arterial highways. There are three controlled-access routes. The Northern and Southern State Parkways which are limited to non-commercial passenger traffic, terminate in the towns of Smithtown and Islip, respectively, and are connected by the Sagtikos-Sunken Meadow Parkway. The Long Island Expressway, open to all traffic, presently extends about 20 miles into Suffolk County and is scheduled to be extended about 30 miles further to Riverhead through the center of the island. In addition, the Jericho Turnpike on the north shore and the Sunrise Highway on the south shore are other routes serving the county as direct links to New York City. The New York State Department of Transportation is in the process of reconstructing the Sunrise Highway into a controlled-access route. There is a good system of secondary State and county roads which connects the study area to the major arterial highways.

20. There are two ferries in operation carrying passengers and vehicles to and from New England. The Port Jefferson ferry to Bridgeport, Connecticut, operates from late May to late September, while the Orient Point ferry to New London, Connecticut, operates from May to October. At present, one commercial airfield, MacArthur Airport in the town of Islip, provides limited scheduled flights to eastern seaboard destinations. There are many private fields throughout the county for small aircraft operation. There are also two airfields in Suffolk County which serve military related purposes. Suffolk County Air Force Base in Westhampton is a base for the Tactical Air Command, while Grumman Airport in Calverton serves the needs of the Grumman Aircraft Engineering Corporation for its research and development programs for military aircraft and for space exploration equipment.

21. BRIDGES UNDER CONSIDERATION. Recently, four studies have been completed by State study groups for the planning of bridges which would span Long Island Sound from Nassau and Suffolk Counties across to shores in Westchester County and Connecticut. One study considered a bridge crossing from Oyster Bay in Nassau County to Rye in Westchester County. A second study considered a crossing from East Marion in Suffolk County to Old Saybrook in Connecticut. A third study considered a crossing from Port Jefferson in Suffolk County to Bridgeport in Connecticut. A fourth and most recent study considered a crossing from Wading River in Suffolk County to New Haven in Connecticut. All of the bridges considered would connect with existing interstate routes and would serve to decrease greatly the travel time to and from Long Island to the upstate areas of New York and New England. While the studies are only in the consideration stage, such structures would have a significant effect on future development in Suffolk County.

22. POLLUTION. The waters of the study area are relatively free from pollution. Most of the domestic and industrial waste is discharged into the ground. There are five sewage treatment plants, located at Huntington,

Northport, Port Jefferson, Kings Park State Hospital and Greenport, which discharge effluent into the waters of the study area. Pollution affects some parts of Huntington, Northport and Port Jefferson Harbors and the Nissequogue River. Boating activity and a certain amount of infiltration and seepage from neighboring cesspools and tile fields contribute to this pollution. The treatment plant at Greenport has its outfall in Long Island Sound, just east of Inlet Point, but the dilution there is so great that the effluents' effect in the waters is negligible.

23. The Interstate Sanitation Commission and the New York State Department of Health have tested and classified the surface waters of the study area. The Interstate Sanitation District includes Long Island Sound and its estuaries and tidal waters between the New York City line and the easterly side of Port Jefferson Harbor. The tidal waters of the north shore of Suffolk County which lie within the District have been classified as Class "A" waters. The same classification has also been assigned by the Federal Water Pollution Control Administration to the waters in the study area. This classification is given to waters which are expected to be used primarily for recreational purposes, shellfish culture or the development of fish life. The New York State Department of Health has given an overall classification of Class SA, for the entire study area, with other classifications being assigned to the tidal waters at river mouths and inlets where the water quality is generally poorer. The SA classification indicates that the quality of tidal salt waters is good enough to allow shellfishing for market purposes as well as other usages such as bathing and finfishing.

24. PROPERTY VALUES. The real value of lands and improvements of the 10 towns of Suffolk County for the years 1949-1950, 1959-1960 and 1965-1966 is given in table 6. It is noted that the value of lands and improvements in the five towns of the study area increased from $242,650,095 in 1949-1950 to $2,647,873,147 in 1965-1966 with Smithtown having the greatest percentage increase.

25. POWER DEVELOPMENT. The Long Island Lighting Company has several electric power plants in operation on Long Island which utilize fossil fuel. In 1965 the firm announced plans for the construction of a 500,000 KW nuclear powered generation plant to be located in Shoreham, just west of the Brookhaven-Riverhead town boundary at Wading River. Construction of the plant was expected to begin late in 1969, with service expected by 1973. In 1965 the New York State Atomic and Space Development Authority ordered the planning for construction of a nuclear powered desalinization plant on Long Island. This pioneer project named "Surfside" (Small Unified Reactor Facility with Systems for Isotopes, Desalting and Electricity), will be built on a 45-acre plot in the Northville vicinity of the town of Riverhead next to the Southold town boundary. Fresh water (1,000,000 gallons daily) from the plant will be purchased by the Riverhead Water District and the electrical output (2,500 KW daily) will be bought by the Long Island Lighting Company. Expected dates of plant completion and operation are not known.

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TABLE 6 - REAL VALUE OF LAND AND IMPROVEMENTS IN SUFFOLK COUNTY, N. Y.*

Town	Real Value of Lands and Improvements in Dollars		
	1949-1950	1959-1960	1965-1966
Study Area			
Huntington	75,427,661.16	521,806,591.00	995,446,900.00
Smithtown	26,412,770.00	138,895,537.00	430,231,700.00
Brookhaven	80,449,392.01	407,435,017.00	953,464,677.00
Riverhead	25,980,134.64	85,186,686.00	122,192,770.00
Southold	34,380,136.34	90,881,679.00	146,537,100.00
Subtotal	242,650,094.17	1,244,205,510.00	2,647,873,147.00
Remaining Area			
Babylon	56,548,400.91	435,711,444.00	839,372,765.00
Islip	92,850,478.68	481,099,796.00	987,307,373.00
Southampton	60,830,236.17	186,193,317.00	341,769,476.00
East Hampton	26,384,456.77	91,467,982.00	154,014,392.00
Shelter Island	4,981,205.30	17,635,712.00	26,076,517.00
Subtotal	241,594,777.83	1,212,108,251.00	2,348,540,523.00
TOTAL	484,244,872.00	2,456,313,761.00	4,996,413,670.00

*Values furnished by Suffolk County Board of Supervisors.

V. STATEMENT OF THE PROBLEM AND IMPROVEMENTS DESIRED

26. THE PROBLEM. The problem in the study area consists of damage to shorefront property and shore erosion by wave action accompanied by inundation of low-lying areas during hurricanes and intense extratropical storms. Shore erosion has caused the loss of protective shore structures and of beach and bluff areas with subsequent structural damages to buildings and roads. Tidal inundation of residences and businesses has required the evacuation of people from affected areas. Damages resulting from wave attack and beach erosion have occurred throughout the entire study area, whereas damages from tidal flooding have occurred, primarily at Port Jefferson and vicinity, at Asharoken Beach, and at several low-lying beach developments.

27. IMPROVEMENTS DESIRED. A public hearing was held at Riverhead, New York, on 19 January 1956 to obtain views and information relative to hurricane flooding and erosion along the tidal shorefront of the study area. Federal, State and municipal representatives and private interests attended the hearing, including representatives of the U. S. Fish and Wildlife Service, U. S. Geological Survey, U. S. Coast Guard, U. S. Bureau of Public Roads, the New York State Department of Public Works and the Suffolk County Department of Public Works.

28. Statements made by local interests and private individuals, either during the public hearing or in connection with it, indicated a desire for a variety of improvements. Groin construction was requested along shores fronting high bluff areas in Northport, Smithtown, Southold and Greenport. Road raising and beach widening combined with groin construction was requested at Asharoken Beach, Long and Short Beaches in Smithtown, Cedar Beach in Mount Sinai, Wading River Beach, and Truman Beach in East Marion. Beach raising was requested for the low-lying areas of Setauket and Port Jefferson and erosion control measures were desired at Strongs Neck. At Old Field Point seawalls were desired to prevent further erosion of the bluff. At Arshamonoque, a continuous bulkhead, beach fill and groins were requested. Construction of groins at Orient Point was requested. At Caumsett, Sunken Meadow and Wildwood State Parks, studies were requested to develop works to prevent storm damages. A desire for authoritative information was requested in order to aid individual property owners in their fight against erosion and tidal flooding, as well as for a localized storm warning system for eastern Long Island. Details of the improvements desired, reasons advanced and other pertinent information furnished at the public hearing are given in appendix L.

VI. FACTORS PERTINENT TO THE PROBLEM

29. CLIMATOLOGY. Climatological observations and measurements in the vicinity of the study area have been recorded at Setauket, Cutchogue, and Riverhead by the U. S. Weather Bureau with the earliest period of record beginning in 1885. The climate of the study area is temperate with an average annual temperature of 52 degrees, Fahrenheit. Observed extreme temperatures during 73 years of record between 1885 and 1960 have been 11 degrees below zero and 98 degrees above zero. The average growing season is about 200 days. The annual precipitation has ranged between a high of

60.50 inches in 1951 at Cutchogue and a low of 26.55 inches recorded in 1965 at Setauket. The average annual precipitation is about 45 inches with its distribution being very uniform throughout the year. Details on rainfall associated with storms are given in appendix D.

30. GEOMORPHOLOGY. Long Island belongs to the inner part of the Atlantic Coastal Plain. Only a part of the deposits of the island are true coastal plain deposits. The greater portion of both the surface and the underlying materials are of Pleistocene age and represent morainal and outwash accumulations associated with the continental glaciers. Cretaceous formations underlying those of Pleistocene age are exposed at several locations within the study area. The extensive unconsolidated sediments underlying the study area are of Cretaceous, Pleistocene and Recent origin, ranging from fine silts and clays to sands and coarse gravel. In the study area bedrock is located generally at depths greater than 500 feet below the surface.

31. The western part of the study area, west of Port Jefferson, consists of high projecting headlands interceded by a series of harbors and bays, while the eastern part, east of Port Jefferson, is faced by a steep scarp rising in places more than 100 feet above mean sea level. The scarp appears to be of erosional origin, having the form of fresh bluffs. However, the scarp form is actually due to constructional forces. Erosion has only cut a narrow shelf in the land mass and worn away a few projecting points. The western part of the study area is also characterized by wave-built forms of Recent origin, such as baymouth bars, spits, and tombolos. A more detailed description of the geomorphology of the study area is presented in appendix B.

32. LITTORAL MATERIALS. Characteristics. Samples of beach and bottom materials were taken in 1965 by the Corps of Engineers to determine the characteristics of littoral materials. Samples were taken along 38 separate ranges generally from 0 to 6 miles apart, as shown on plates 2 to 14. These samples were generally taken at the backshore area, at the high water, midtide, and low water lines, and at the 6, 12, 18, 24 and 30-foot depths below mean low water. Their locations on the profiles are shown on plates 29 to 40. Tabulations of the characteristics of the materials obtained and of the statistical parameters used to characterize the sand along the ranges are given in tables B2 and B3 of appendix B. Generally, the mechanical analyses indicated that the littoral materials consist of fine to coarse sands mixed with varying amounts of gravel, with medium sand being predominant. Grain size diameters of the materials analyzed ranged from 0.03 mm to 76.2 mm, while the median diameters ranged from 0.14 mm to 58.0 mm with no one size being predominant. However, about 59 percent of the samples had median diameters in the range of 0.42 mm to 2.0 mm.

33. A statistical analysis of the samples indicated that beach materials (backshore to low water line) were generally coarser than bottom materials (6 to 30-foot depth). Examination of the natural sorting indicated that beach materials were predominately poorly sorted, while the sorting of

bottom materials ranged from good to well. In the vicinity of projecting headlands west of Port Jefferson, it was found that many samples showed evidence of poor or incomplete sorting. Skewness parameters computed for the samples indicated that beach materials taken at the backshore at the midtide line and at the bottom between the 18 and 30-foot depths, were predominately skewed on the coarser side of their respective median diameters. Beach materials taken from the high and low water lines and at the bottom from the 6 to 12-foot depths, ranged through many grade sizes.

34. Sources. The sources of littoral material along the shores of the study area are the projecting headlands and high bluffs which are undergoing erosion. Much of the finer materials are carried offshore to be deposited in large shoals which occur in the vicinities of the eroding shores. Generally littoral currents do not carry sufficient material to nourish adequately the downdrift shores. However, along some shores such as at Friars Head in Riverhead, construction of long groins have impounded short beaches of appreciable width. It was found that the predominant direction of littoral drift is generally from west to east, except at projecting headlands where the direction of littoral drift is often split along two directions.

35. LITTORAL FORCES. Waves, currents, winds, ice and tides affect the movement of littoral materials. Data regarding these forces in the study area are presented in appendix C and summarized in the following paragraphs. Information on the effect of storms on the shore is contained in appendices D and K.

36. Waves. No wave measurements or statistical wave data were available for Long Island Sound. The shore of the study area is not affected by ocean swells. Short period, wind generated waves along limited fetches across Long Island Sound from the northeast to northwest quadrants strike the shores of the study area. Waves so generated are generally shallow water waves with maximum heights of 4 feet to 8 feet, respectively, from Orient Point at the east to Cold Spring Harbor at the west, based on tide levels of at least 3 feet in excess of the mean height of high water. However, during infrequent higher tides, such as those occurring during hurricanes, larger waves can reach the shore. Fetch distances by direction in the study area are listed in table C1 of appendix C.

37. Currents. Tidal currents along the shores of the study area are generally weak except at the entrance to Port Jefferson Harbor and in the eastern part of the study area from Terry Point to Plum Gut. At these points, the maximum currents range from 0.5 to 3.5 knots on the flood and from 0.6 to 4.3 knots on the ebb. A current observation survey by the U. S. Coast and Geodetic Survey in Long Island Sound which was completed in 1968 will provide revised values of current velocities in the study area. Current velocities and directions as published by the U. S. Coast and Geodetic Survey in 1969 are listed in table C2 of appendix C.

38. Winds. Wind data from observations at Westhampton Beach, New York and at LaGuardia Airport in New York City are presented on figures C1 to C6 of appendix C. Based on comparison of these data with data observed at Brookhaven National Laboratory in Upton, New York, which is closer to

the study area, the annual prevailing winds are from the southwest quadrant 33 percent of the time at Upton and 35 percent of the time at Westhampton Beach, but are from the northwest quadrant 31 percent of the time at LaGuardia Airport. Winds from the northeast quadrant occurred about 24 percent of the time at LaGuardia Airport. A diagram showing prevailing winds over land and sea in the northeastern region of the Atlantic Ocean is presented on plate 1 of this report. As shown on the chart, prevailing winds are from the northwest to southwest directions. Data on maximum winds are summarized in table C3 of appendix C. Velocities of over 100 miles per hour may be encountered during severe storms.

39. Ice conditions. There are no known problems due to ice conditions along the shores of the study area.

40. Tides. Tides along the Suffolk County shore of Long Island Sound are semi-diurnal and have a mean range varying from 7.4 feet at Cold Spring Harbor at the westerly limit of the study area to 2.5 feet at Plum Gut Harbor, which is just east of Orient Point, the easterly limit (plate 1). The spring ranges are 8.7 feet and 3.0 feet at the respective locations. The mean and spring ranges of tides at various locations in the study area are listed in table C4 of appendix C.

41. The maximum recorded storm tide elevation in the vicinity of the study area was 13.3 feet above mean sea level, as obtained from the U.S. Coast and Geodetic Survey tide gage at Willets Point, N. Y. during the hurricane of 21 September 1938. The peak surge of this storm which is the maximum of record at Willets Point, was 9.5 feet and occurred coincident with the maximum storm tide at about two hours before the predicted high tide of 4.6 feet above mean sea level. Within the study area the highest tides occurred at Port Jefferson Harbor on 31 August 1954 with an elevation of 9.45 feet above mean sea level. Tidal heights and storm surges occurring during severe storms at various locations in the study area and vicinity, including several comparable locations on the Connecticut shore of Long Island Sound are listed in table C5 of appendix C. Tide and surge histories at Willets Point for the hurricanes of 21 September 1938 and 31 August 1954, are shown on figures C7 and C8, respectively, of appendix C.

42. Based on observed mean and storm tides for comparable shore locations on the opposite sides of Long Island Sound, a close correlation was found for the hurricane of 31 August 1954, but for the hurricane of 21 September 1938, tides were up to 2.5 feet higher along the study area shore. Profiles of tidal elevations experienced along the Connecticut shore during these hurricanes are shown on figures C9 to C16 of appendix C. Frequency curves of tidal flooding from hurricanes and storms at Willets Point, New York, and at Stamford, Stratford and New London, Connecticut, are shown on figures C17 to C20, respectively. These curves show that tidal levels of 3.0 feet above mean high water occur at least once a year.

43. STORMS. The study area is subject to damages from hurricanes and extratropical storms which are also known as "Northeasters". The characteristics of these storms are described in paragraphs 44 to 48. Historical data on hurricanes and storms are contained in Technical Paper No. 36

of the U. S. Weather Bureau entitled "North Atlantic Tropical Cyclones, Tracks & Frequencies of Hurricanes and Tropical Storms, 1886-1958", a book by David M. Ludlum entitled "Early American Hurricanes, 1492-1870", and in old newspapers. A summary of the history of storms and hurricanes is contained in appendix D. Details on their effects are contained in appendices D and K.

44. Hurricanes. The type of storm which affects the study area most severely is the hurricane with its high winds, waves, rainfall, and tidal flooding. This term is applied to a cyclonic storm which originates in the tropical or subtropical latitudes of the Atlantic Ocean and moves erratically in a direction generally following a curved path changing from an initial northwest to a final northeast direction, and may affect localities along the entire Atlantic or Gulf coasts of the United States

45. Most of the hurricanes that have affected these localities have formed either near the Cape Verde Islands or in the Western Caribbean Sea. Cape Verde hurricanes move westerly for a number of days with a forward speed of about 10 miles per hour. Occasionally, they proceed straight to the coast of Texas, but generally, after reaching the Middle Atlantic Ocean, they recurve northerly and then easterly. Frequently, they cross the West Indies, sometimes striking the eastern coast of the United States between Key West, Florida, and Cape Cod, Massachusetts. After recurving, the forward speed of the storms usually increases to a rate of 25 to 30 miles per hour and occasionally to 60 miles per hour. The hurricanes which form in the Caribbean Sea generally move in a northerly direction, across Cuba, then strike either the Gulf or the southeastern shores of the United States. The hurricanes that most severely affect the study area usually approach from the south-southwest after recurving east of Florida and skirting the Middle Atlantic States. The tracks of recent major hurricanes are shown on figure D1 of appendix D.

46. The center or "eye" of the hurricane is an area of low barometric pressure and dead calm, normally from 7 to 20 miles in diameter. Winds blow in a counterclockwise spiral around the center, with maximum winds generally occurring about 15 to 60 miles from the center, but winds of 50 miles per hour may occur as far as 150 miles from the center. Since wind movement approaches the center in the counterclockwise spiral, the highest wind velocities may occur from a easterly or westerly direction from the hurricane's center. In the case of the study area, the effect of high winds from the easterly direction causes the waters of Long Island Sound to pile up and rise to inundate low-lying shore areas. When the eye of the hurricane is in the vicinity of the sound, winds on the left periphery tend to strike the shore directly. Further data on winds and wind directions are given in paragraphs C6 and C7 of appendix C.

47. Atmospheric pressure falls rapidly as the center of the hurricane approaches and as the velocity of the wind increases. Minimum barometric readings do not always occur in the center of the eye. In some instances, the minimum is reached at the beginning of the calm period, while in others, it is reached at the end. Usually, the barometric low is about two inches below the normal sea level pressure of 30 inches. However, in several hurricanes, pressures as low as three inches below normal have

been recorded. The lowest barometric pressure of record in the United States is 26.35 inches and was recorded at the northern end of Long Key, Florida on 2 September 1935.

48. Extratropical storms. In the northeaster, wind speeds are generally not as great and central pressure is not as low as they are in a severe hurricane. The wind field of a northeaster is less symmetrical than that of a hurricane and covers a much greater area. The forward motion of the storm is more likely to slow down. Thus, it may produce prolonged periods of onshore winds which may result in longer periods of flooding and wave attack.

49. Severe storms. Eight major storms struck the region during the past 30 years. All of these storms caused some tidal flooding, shore erosion and damage to shorefront development in the study area. These storms consisted of the following four hurricanes and four extratropical storms:

Hurricanes	Extratropical storms
21 September 1938	25 November 1950
14 September 1944	6-7 November 1953
31 August 1954 (Carol)	14-17 October 1955
12 September 1960 (Donna)	6-8 March 1962

50. STORM FREQUENCY. Based on a historical study of storms, 231 hurricanes and other tropical and extratropical storms have passed through a 200-mile band in the general vicinity of the study area, between the years 1635 and 1962, or an average of one every one and a half years. Some of these storms passed outside the area and either caused minor damage or only threatened the vicinity. However, since 1900, storms have damaged or threatened this area on the average of approximately twice a year. This difference in frequency may be partially attributed to the incompleteness of the record prior to 1900. Using the frequency curve for Stratford, Connecticut (figure C19, appendix C), adjusted for Port Jefferson Harbor, New York, it was found that the maximum tide of record of 9.45 feet above mean sea level occurring during the hurricane of 31 August 1954 at Port Jefferson Harbor, would be expected to occur about three times in 100 years.

51. The total number of storms of record that either damaged or threatened the north shore of Long Island in Suffolk County, arranged by categories and time intervals, is shown in table 7.

TABLE 7 - FREQUENCY OF STORMS IN THE STUDY AREA

Category	Time interval				
	1635 to 1700	1701 to 1800	1801 to 1900	1901 to 1962	1635 to 1962
Unusually severe	2	2	3	1	8
Severe	1	2	6	6	15
Moderate	2	9	33	45	89
Threatened the area	1	8	34	76	119
Total	6	21	76	128	231

52. HURRICANE WARNING. The U. S. Weather Bureau, as part of its responsibility for improved weather services in connection with major storms and hurricanes, has established a "severe weather" network along the Atlantic coast, utilizing powerful radarscopes. Radar installations at Nantucket, Atlantic City and Cape Hatteras are part of the network linked to the Weather Bureau office in New York City by means of teletype communication. During periods of hurricane threat the New York City office issues warnings to the public by radio over several powerful radio and television stations in the metropolitan area. In addition, teletype weather bulletins are available from that office to anyone who subscribes to the teletype service. In order to provide continuous data on storm water levels, tide gages at the Battery and Willets Point have been remoted to the Weather Bureau in New York City for use in the warning service. A general description of the existing hurricane warning service and suggestions for improvement are contained in Chapter 6 of the preprinted Report No. 5 of National Hurricane Research Project, prepared by the U.S. Weather Bureau under Public Law 71, 84th Congress, 1st Session. Efforts are also being made by the Weather Bureau to inform all public agencies or officials of the potential hazards of hurricanes. The Weather Bureau suggests the establishment of emergency hurricane plans which could be readily activated at times of a threatened hurricane for the purpose of taking the necessary steps after warnings are received, to minimize loss of life and damage to property. A "Model Hurricane Plan for a Coastal Community" has been prepared by the Weather Bureau in collaboration with the Corps of Engineers and is published as National Research Project Report No. 28. The report covers the development of improved warning and evacuation plans, including necessary coordination with other Federal, State, and local agencies. A copy of this report is included in appendix N of this report. Additional copies of this report may be obtained from the New York District, Corps of Engineers, New York City, for guidance in developing community hurricane preparedness plans.

53. FEDERAL FLOOD INSURANCE ACT OF 1956 (PUBLIC LAW 1016, 84TH CONGRESS). This act, approved 7 August 1956, authorized the establishment of a program of Federal insurance against damage from any flood, tidal wave, wave wash or other abnormally high tidal water. In adopting the act, Congress

found that the safeguards of insurance are a necessary adjunct to preventive and protective means and structures. The face amount of insurance which would be issued under the act is limited to $250,000 per person and may not exceed $10,000 on any dwelling unit including any structures and personal property connected therewith. No insurance would be issued on any property declared by a state or local zoning authority to be in violation of state or local flood zoning laws. The act also established a Government-guaranteed loan program under which loans of up to $10,000 a home or $250,000 a person would be available at an interest rate not to exceed 4 percent. However, this program has not been implemented.

54. NATIONAL FLOOD INSURANCE ACT OF 1968 (PUBLIC LAW 448, 90TH CONGRESS). This act which was approved 1 August 1968, amended or repealed sections of the Federal Flood Insurance Act of 1956. In addition, the Secretary of Housing and Urban Development was authorized to establish and carry out a national flood insurance program which would enable interested persons to purchase insurance against loss that would result from physical damage to or loss of real property or personal property related thereto that would arise from any flood occurrence in the United States. The limits of liability in the case of residential properties would be an aggregate of $17,500 for any dwelling unit, $33,000 for any single dwelling structure containing more than one dwelling unit, and an aggregate of $5,000 per dwelling unit for any contents related to such unit. Similar provisions are made for business properties which are owned or leased and operated by small business concerns.

55. FEDERAL HOUSING ACT OF 1949 (PUBLIC LAW 71, 81ST CONGRESS). This act, as amended, authorized the Urban Renewal Program under which assistance in the form of loans and grants for the planning and execution of urban renewal projects is administered by the Urban Renewal Administration, a constituent unit of the Housing and Home Finance Agency. This agency requires that, with regard to urban renewal projects in which they participate for areas subject to flooding, "planning proposals shall be designed to prevent danger to human life or serious economic loss... If definite steps are not being taken to eliminate or minimize the possibility of future flood damage, the Urban Renewal Plan shall establish only such land uses as are suitable for the area without danger to human life or without serious economic loss."

56. FLOOD PLAIN INFORMATION STUDIES (PUBLIC LAW 645, 86TH CONGRESS). In Section 206 of the Flood Control Act of 1960, approved 14 July 1960, as amended, Congress authorized the Secretary of the Army, through the Chief of Engineers, to provide flood plain information to states and local communities upon their request, and to aid them in regulating the use of flood plain areas. This regulation authorizes compilation and dissemination of information on floods and potential flood damages, including identification of areas subject to inundation by floods of various magnitudes and frequencies. The legislation does not extend any Federal authority over zoning or regulation of flood plain use. These controls remain a state and local responsibility.

57. SHORE HISTORY. The following paragraphs present data on shoreline and offshore depth changes in the study area between 1836-38 and 1965, prior corrective action and structures, profiles, and volumetric accretion and erosion. Detailed information on these items is given in appendices E and F.

58. Shoreline and offshore depth changes. The shoreline of the study area is receding at an average rate of between 1.0 to 2.0 feet per year. Some locations such as at Eatons Neck, Waterside Park, Fort Salonga, Crane Neck and Old Field Points, Mt. Misery, and Mattituck Hills have experienced severe recessions of up to 3.5 feet per year. The shoreline from Miller Place to Mattituck Inlet, fronted primarily by high bluffs lying in long and gently curved reaches, has generally experienced a constant recession of about 2.0 feet per year. Shoreline accretion has occurred primarily at locations where wave-built forms such as sand spits and barrier bars exist. At some of these locations such as Lloyd Neck, East Fort and Eatons Neck Point, Sunken Meadow State Park, Port Jefferson Harbor, and at Mt. Sinai Harbor, the bars or spits have experienced migrations of considerable magnitude. Comparative high water shorelines and offshore depth contours at various times are shown on plates 16 to 28. An index of the shore areas covered on each plate is shown on plate 15.

59. During the period of record, offshore depth contours in the study area generally retreated (landward movement). In the vicinity of offshore shoals at projecting headlands, along barrier bars, and offshore of entrances to harbors and estuaries, there were advances (seaward movement) of up to 3,500 feet during short periods. Some locations where significant movements of the offshore depth contours occurred are: Lloyd Point; Eatons Neck Point; Asharoken Beach; Crab Meadow; Crane Neck Point; Mt. Misery; Rocky Point Landing; Herod Point; Roanoke Point and Goldsmith Inlet.

60. Prior corrective actions and structures. Examination of older hydrographic surveys shows the existence of many shore structures such as groins and jetties by 1885. However, detailed information on prior corrective actions and structures generally dates back to about 1927, and is presented in tables F1 and F2 of appendix F. Existing structures in the study area are indicated in numerical sequence on plates 2 to 14 and are described in table F1 of appendix F. The extent of shore protection found in the study area consists of 236 groins, 14 jetties and 46,480 linear feet of seawalls, revetments, and bulkheads. Artificial nourishment operations in the study area have been accomplished only at Asharoken Beach in 1960 and 1964 in the amount of 840,000 cubic yards, and at Sunken Meadow State Park in 1957 in the amount of 57,000 cubic yards. Details on artificial fill placement in the study area and vicinity are given in table F2 of appendix F. Dredging operations in the study area under Corps of Engineers permits are given in table F3 of appendix F.

61. Effectiveness of protective measures. The effectiveness of shore protection constructed in the study area was evaluated on the basis of available design information and the condition of the protection as found during field inspections. Generally, existing shore structures were

found to be in various states of repair, with structures built by public interests generally being in better condition than those built by private interests. Structures built by private interests showed a greater variance in design and construction, and were generally less effective than those built by public interests. The lack of coordinated planning between individual private property owners has resulted in segmented protection in shore reaches. In many cases the installed protection has been rendered ineffective by erosion of the upland shore flanking the structures. Failure to provide for control of rainfall runoff on bluff slopes has resulted in severe erosion and slope failures.

62. Groins constructed in the study area have been generally effective only in holding beaches, but not in building them up. This condition is primarily due to an inadequate supply of sand in the alongshore littoral drift. Groins constructed with quarry stone generally withstood the elements better than those built with boulders, timber sheet piles, concrete blocks, pre-cast concrete beams, and filled concrete pipe.

63. Placement of sand fill to restore and widen beaches is an infrequently accomplished measure in the study area. At Asharoken Beach two massive fills were accomplished by the State of New York. However, losses of the fill material have been very large. Material dredged from inlets and channels and spoiled on the adjacent shores, has served to stabilize these shores and permit vegetation to establish itself.

64. Shore protection measures proposed by local interests. The New York State Conservation Department has proposed shore protection improvements for West Crab Meadow Beach, Fort Salonga, Eatons Neck, Wading River and Goldsmith Inlet. At the time of this report surveys had been completed at West Crab Meadow Beach and Fort Salonga, but design work had not been initiated. At Eatons Neck, a 5,300-foot long concrete crib is proposed along the toe of eroding bluffs. At Wading River dune and beach restoration is proposed for 4,500 feet of shore east of Wading River Creek. At Goldsmith Inlet, the construction of eight pre-cast concrete groins, each about 85 feet long, is proposed for 3,600 feet of shore east of the Inlet.

65. Profiles. Profiles were taken along 70 ranges in the study area in 1965. They generally extend from the top of the bluffs and dunes seaward out to the 30-foot depth contour, and are shown in plan on plates 2 to 14 and 16 to 28, and in profile on plates 29 to 40. Typical bluff slopes on the plotted profiles vary from 1 on 1 to 1 on 5, with the average slope being close to 1 on 2. Foreshore slopes vary from 1 on 7 to 1 on 30. Offshore slopes vary from 1 on 50 to 1 on 400. No comparative profiles are included with the report. Profiles were interpolated along the 1965 ranges from various hydrographic surveys that were taken between 1836-38 and 1916 at Caumsett, Sunken Meadow and Wildwood State Parks, and were plotted comparatively for use in determining volumetric erosion and accretion studies.

66. Volumetric changes. As indicated in paragraph 65, volumetric erosion and accretion studies were made at Caumsett, Sunken Meadow and Wildwood State Parks by comparison of the 1965 profiles with profiles interpolated from surveys of 1836-38, 1886 and 1916. Data on accretion and erosion on selected profiles at the three State park locations are contained in table E1 of appendix E. Annual rates of volumetric accretion or erosion on the same profiles are listed in table E2 of appendix E. An examination of these data indicate that at Caumsett State Park the maximum rate of erosion was 12.5 cubic yards per year at profile 4 occurring between 1886 and 1916, while the maximum erosion between 1886 and 1965 was 4.0 cubic yards per year at profile 6. At Sunken Meadow State Park the maximum rate of erosion was 4.9 cubic yards per year occurring between 1886 and 1965 and 3.5 cubic yards per year between 1836-38 and 1965, both these rates occurring at profile 24. At Wildwood State Park, the maximum rate of erosion was 12.8 cubic yards per year occurring between 1836-38 and 1886, and 9.1 cubic yards per year between 1836-38 and 1965, both of these rates occurring at profile 49.

VII. EXTENT AND CHARACTER OF FLOODED AREA

67. EXTENT OF FLOODED AREA. The hurricane of 31 August 1954 (Carol) which produced the highest water levels in the study area, caused tidal inundation over a total area of approximately 2,600 acres. Significant flooding occurred at Lloyd Harbor, Asharoken Beach, Crab Meadow, Sunken Meadow State Park, Flax Pond, Port Jefferson Harbor and the immediate vicinity of Mt. Sinai Harbor and Hashamomuck Beach.

68. CHARACTER OF DEVELOPMENT. The land use and development of the area subjected to flooding is primarily residential, recreational and commercial. These types of development suffer a very high proportion of all damage. In addition, there are a number of boatyards, public and private institutional facilities, public roadways and Federal property which are affected.

69. EFFECT ON TRANSPORTATION. As a result of tidal inundation of local streets and highways, hardships are experienced by people due to the impassability of these arteries. In some cases, roadway washouts required extensive repairs before normal traffic could be resumed.

70. EFFECT ON THE PUBLIC. Although no lives were lost in the study area as a result of the hurricane of 31 August 1954 (Carol), people residing in the area suffered considerable hardship due to damage and destruction of homes, small businesses and other private property.

VIII. EXTENT OF FLOOD DAMAGES

71. EXPERIENCED DAMAGES. The hurricane of 31 August 1954 (Carol), which produced the maximum flood height of record, caused over $700,000 (1954 prices) of primary physical and non-physical damage in the study area. Many residential and some commercial buildings were severely damaged. Small craft and waterfront facilities were badly hit. Public utilities

and transportation were adversely affected. Beach erosion and damages to shore protection structures were extensive. A detailed discussion of damages are contained in appendix K.

72. RECURRING DAMAGES. The conditions in the study area have been restored substantially to those existing prior to the hurricane of 31 August 1954 (Carol) including replacement of structures, facilities and beach lands destroyed during the storm. It is estimated that the recurrence of the maximum tidal heights which accompanied the storm of 31 August 1954, would cause $1,083,800 (March 1969 prices) of primary physical and non-physical damage. However, the damages which would result from the recurrence of the maximum tidal heights would be considerably increased due to a number of residential and commercial structures and shorefront developments which have been constructed in the study area since the storm of record.

IX. ANALYSIS OF THE PROBLEM

73. SHORE EROSION PROBLEM. In the study area, the problem of shore erosion is very severe. The high projecting headlands and bluffs which characterize the shore are generally fronted by low, narrow beaches which provide insufficient protection against erosion from tidal action and wave attack. Littoral drift being carried by alongshore currents generally is not providing sufficient nourishment for beaches. Slopes which have become denuded of vegetation and have eroded as a result of unstable conditions at the toe of the slope, are further eroded by surface runoff resulting from rainfall. In some cases natural springs flow out through exposed water bearing aquifers in the slope faces. The saturation of unconsolidated bluff materials results in slides of bluff segments. Residential development along the shore of the study area has increased sharply during the past 20 years and much of it was constructed very close to the top edge of the bluff slopes. Erosion has undermined many of these residences and threatens to undermine more with the passing of time.

74. Much residential and business development has also been built up in low-lying areas along the shores of barrier bars joining headlands or fronting tidal marshes. Asharoken Beach, Fresh Pond, Port Jefferson, Wading River Landing, Luce Landing and Hashamomuck Beach are examples of such areas. Erosion of these shores due to wave attack and overtopping has resulted in damages to the shorefront development. During hurricanes or infrequent northeastern storms, damage to all shorefront development is more severe, with the erosion and resulting land loss being at times equal to the average loss normally occurring over a 10 year period. Analysis of shoreline and offshore depth contour movements over 128 years of record confirms such significant losses of shore due to erosion. In general, the retreat of the shoreline has been more consistent than that of the offshore depth contours which have experienced massive advances and retreats at various times during the period of record. Advances of offshore depth contours have occurred in the vicinities of large offshore shoals. Undoubtedly, much of the materials eroded from the headlands and bluffs is being deposited in these shoals.

75. The Federal Government, the State of New York, local municipalities, and numerous private interests have constructed and provided shore protection works such as beaches, jetties, groins, seawalls, revetments and bulkheads. Although the work accomplished offers a measure of protection, many additional improvements are required at this time to preserve the shoreline and protect the shorefront development. Only about 16 percent of the shoreline is publicly-owned and private interests find the cost of constructing protective works along privately-owned shore to be beyond their capability. The inability to provide the necessary protection has brought about significant losses in property values.

76. HURRICANE PROBLEM. The hurricane problem, is concerned with tidal flooding from the sound and bay waters. Storm tides created by high winds and low barometric pressure accompanied by wave action have inundated areas such as Asharoken Beach, Sunken Meadow State Park, Port Jefferson Harbor and vicinity, Wading River and Hashamomuck Beach with resultant property damage and dangers to health and safety. The highest tides in the study area occurred during the hurricane of 31 August 1954. Based on a study of the history of storms from 1701 to 1962, a storm of this magnitude would occur about three times in a 100-year period. There are no existing improvements in the study area designed to protect against hurricane flood inundation. Some existing shore protection works provide protection against tidal inundation during occurrences of spring tides. Additional improvement works are required at other locations to provide protection against storm-induced tides.

77. An adequate hurricane warning system is essential in the study area, as well as evacuation plans, to minimize future flood damages and to avoid loss of life during severe storms and hurricanes. The U.S. Weather Bureau operates a hurricane warning system which is constantly being evaluated and improved. A weather-reporting service designed primarily to spread hurricane warnings has been instituted by the Suffolk County Civil Defense Office. It provides for direct teletype service from the U. S. Weather Bureau Office in New York City to civil defense headquarters in Yaphank from which weather bulletins would be disseminated by telephone to civil defense offices in each town. The offices would be staffed 24 hours a day during periods of threatened emergency and local police would be available for assistance. However, within affected communities there is a need for hurricane preparedness plans, which should be a function of Civil Defense Organizations operating under the State Civil Defense Coordinator. Emergency preparations with such a program, which could be readily activated at times of a threatened hurricane for purpose of taking the necessary steps after warnings are received, will reduce the potential loss of life and damage to property.

78. METHODS OF CORRECTION. Local interests have requested methods of correcting the shore erosion and flooding problems discussed in paragraphs 27 and 28. Specific requests for corrective measures have been studied in detail, and where improvements appeared practicable, consideration was given to formulating a plan of improvement. In the following paragraphs corrective measures are indicated for typical problems encountered in the study area. Descriptions of considered plans of improvement are given in

paragraphs 94 to 98. Details on corrective measures for problems at specific shore locations in the study area are given in appendix H. Typical shore protection structures are shown in detail on figure H1 of appendix H.

79. Inundation of low-lying roadways. Low-lying roadways such as those extending along narrow barrier bars to Lloyd Neck, Asharoken Beach, and Truman Beach are subjected to tidal inundation and undermining during severe coastal storms or hurricanes. In order to insure that the roadways remain passible to vehicular traffic during these conditions, they should be raised to an elevation above the storm water level. The roadway embankments should be protected with placed riprap stone to prevent undermining.

80. Beach erosion. Most of the beaches in the study area are undergoing erosion and other beaches no longer exist above high water because of erosion. To correct this condition, beaches should be widened and restored by the artificial placement of sand fill. After the initial work is accomplished, the beaches should be periodically nourished to maintain their effectiveness. Periodic nourishment will also help to preserve barrier bar beaches and spits. Another method for providing a continuing source of nourishment is the establishment of a feeder beach at the updrift end of the shore from which beach material can be distributed by the natural littoral drift. If losses of beach fill are excessively high, then groins may be considered to hold and retard the loss of the restored beach. Provision should be made in the design of groins to allow bypassing of beach material to nourish the downdrift shore.

81. Bluff erosion. Erosion of the toe of bluffs by wave wash or attack can be corrected by the construction of protective structures such as stone mounds, revetments and bulkheads, or by the restoration of a protective beach or by a combination of these. Where such protective works are to be constructed along the toe of bluffs, their installation should be as continuous and as uniform as possible to preclude the bypassing of the protection. When this condition exists, erosion of the backshore occurs along the unprotected areas and eventually results in a deterioration of the adjacent protective works. Also the ends of the constructed works should tie into high ground to prevent flanking by waves and erosion of the upland shore. Erosion of the slopes of bluffs by rainfall runoff can be corrected by grading or restoring the slope to a natural angle of repose, by constructing intercepting drainage ditches and by planting with shrubs and grasses indigenous to the area. If a greater degree of protection is desired, a blanket of appropriately sized stones can be placed on the slope.

82. Tidal flooding in developed shore areas. Shore areas which have a concentration of development, and which are subject to flooding by tidal inundation during severe storms or hurricanes, can be protected by the construction of dunes, levees or floodwalls along the affected shores and barriers across inlets, bays or harbors to repress high tides and waves, or by a combination of these measures.

83. DESIGN CRITERIA. A summary of the design criteria as applied to the considered plan of improvement at Sunken Meadow State Park are presented in the following paragraphs. The considered protective measures are designed to provide beach erosion protection and some protection against the very frequent storms. The height of the protection was established to minimize backshore erosion and annual maintenance. Details on the development of the design criteria for both beach erosion control and hurricane protection are given in appendix G.

84. Protective beach design. Design of the protective beach was based on the need to protect the backshore from being adversely affected by wave attack during the design storm and to meet the needs of recreation. The design height of the beach berm was based on the stable portions of the existing natural backshore at Sunken Meadow State Park. The design berm level was established at 13.0 feet above mean low water. The design berm width was based on the width required to provide the necessary protection for the backshore or to meet the recreational needs. Along the bluff area and on the barrier bar beach, the width was established at 100 feet. Along the recreational beach fronting the boardwalk the berm width was increased to 150 feet to provide additional beach area for recreational purposes. Based on the stable existing shore slopes a foreshore slope of 1 on 20 was established for the initial beach fill placement which is attainable by hydraulic methods. The fill slope will be reshaped by littoral forces and will eventually assume the existing foreshore slope. The sand for the beach fill would have size and gradation characteristics similar to that of the existing beach materials.

85. Design tide elevation for shore protection. The design tide was established so that the wave runup occurring from a wave breaking at the toe of the beach fill on the design tide would be contained by the beach berm height of 13.0 feet above mean low water. This resulted in a design tide of elevation of 10.0 feet above mean low water with a maximum runup of 2.9 feet. This design tide is 3.0 feet higher than the mean high tide level of 7.0 feet above mean low water. The frequency of tidal flooding at Sunken Meadow State Park is the same as that occurring at the tide gage at Stratford, Connecticut, which is on the opposite shore of Long Island Sound. This frequency is shown in figure C19 of appendix C. Based on this frequency relation, the tidal stage of 3.0 feet above mean high water has an occurrence of about once each year.

86. Design wave. The design wave used is the maximum wave that can be sustained without breaking in the depth of water at the toes of beach fill and stone structures, if the fetch is not a limiting factor. The maximum wave height, H_b, is obtained from the relationship

$$H_b = 0.78\ d_b$$

where d_b is the depth of water at a breaker's position. At Sunken Meadow State Park the maximum depth of water at the toe of the considered beach fill would be four feet below mean low water. With the design tide of 10.0 feet above mean low water, the maximum wave height which could be supported at the toe of the beach fill without breaking would be about 10.9 feet. Examination of the wind fetches and water depths across Long

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Island Sound from Sunken Meadow State Park indicate that the 10.9 foot wave height can be generated within the North and North-northeast fetches.

87. Jetty design. Design of the jetty at Sunken Meadow State Park is based upon the need to hold the beach fill from moving into the Nissequogue River. The total jetty length is 560 feet. The top elevation for the shoreward section of 15.0 feet above mean low water would provide a two-foot freeboard height above the beach berm elevation for impoundment of beach sand. The top elevation for the seaward section of 9.0 feet above mean low water will permit construction during high tide periods. The length of jetty is designed to impound a mean high water beach width up to 50 percent greater than the width of the restored proposed beach. The jetty profile is shown on plate 41.

88. The jetty is not expected to have any detrimental effect on the shore adjacent to the east side of the inlet. The present configuration of this shore is due primarily to construction of the "sand jetty" at the east side of the inlet (see table F3 of appendix F - Dredging Operation Along Shorefront). The littoral drift on the west side of the inlet is generally from west to east, while on the east side of the inlet it is from east to west. The beach along the shore on the east side of the inlet, Short Beach, does not appear to be affected by littoral action west of the inlet.

89. Groin design. The function of the groin is to retard the loss of sand fill with minimum interference with littoral movement, and to build and widen the protective beach by trapping littoral drift. Groin lengths are based on anchoring in the bluff and extending seaward so as to interrupt the strong alongshore currents to minimize erosion and still permit littoral drift around and over the end of the groins. The spacing of groins in a continuous system is a function of the length of the groin and the expected alignment of the accretion fillet. The length and spacing must be so correlated that when the groin is filled to capacity the fillet of material on the updrift side of each groin will reach to the base of the adjacent updrift groin with a sufficient margin of safety to maintain the minimum beach width desired or to prevent flanking of the updrift groin. The extent of probable beach recession must be also taken into account in establishing the length of the horizontal shore section of groin and in estimating the minimum width of beach that may be built by the groin system. On these basis the possible future requirement for five groins to hold the beach fill was determined. The groin lengths would be from 430 feet to 510 feet. The groins would provide for impounding a beach having a mean high water width 50 percent greater than the width of the restored beach.

90. Annual nourishment. The annual nourishment requirement for the considered restored beach has been established for design purposes as 50,000 cubic yards per year. This requirement was based on the average of computed rates of erosion taken along profiles 23, 24 and 25 at Sunken Meadow State Park as given in table E2 of appendix E.

91. Local corrective measures. Any corrective measures undertaken by local interests should be implemented with the assistance of qualified

persons or firms. Design of protective works should conform to principles and criteria given in Technical Report No. 4 of the U.S. Army Coastal Engineering Research Center, entitled "Shore Protection Planning and Design". The publication is available for sale from the U.S. Government Printing Office, Washington, D.C.

X. PLANS OF IMPROVEMENT

92. IMPROVEMENT CONSIDERED. During the initial phase of the study, a reconnaissance was made of the 87 miles of shore in the study area. After identification of problem areas which had been observed during the reconnaissance and which had been indicated by local interests for improvement, a field inspection was made of each location to determine the character of the area, the problems affecting it and the extent of damages caused by storms or hurricanes. In those areas which were most seriously affected and where there appeared to be a sufficient public interest, detailed consideration was given to developing plans of protection for beach erosion control and/or hurricane protection. Problems from tidal flooding during hurricanes and storms are limited to only a few locations, since a large portion of the study area consists of high ground.

93. Plans of improvement were considered for shore protection at Caumsett, Sunken Meadow and Wildwood State Parks, and for hurricane flood protection at Asharoken Beach and Port Jefferson Harbor and vicinity. A description of the plan at each location is given in paragraphs 94 to 98. The considered plan of improvement at Sunken Meadow State Park is shown on plate 41. Since corrective measures had been made by the State of New York to control beach and bluff erosion at Old Field Point, Scotts Beach and Wading River Landing, no further consideration was given to these areas. Corrective measures are being studied by the State for similar problems at West Crab Meadow Beach, Fort Salonga, Eatons Neck and Goldsmith Inlet. The erosion at Short Beach in Smithtown has been corrected by spoiling beach material dredged from the Nissequogue River. The erosion at Cedar Beach has been corrected by placement of spoil material from Mount Sinai Harbor. No detailed consideration was given to beach erosion control improvements at Asharoken Beach, Setauket, Strongs Neck, Arshamonoque and Truman Beach due to the lack of public benefits resulting from public ownership or public use at these locations. Details on possible corrective measures by local interests for problems in these areas are given in appendix H.

94. Sunken Meadow State Park. The considered plan of improvement at Sunken Meadow State Park, including 1,150 feet of shore at Callahans Beach at the western end of the improvement which is owned by the town of Smithtown, provides for widening and restoration of 13,450 feet of beach by artificial placement of beach fill. The beach would have a minimum berm width of 100 feet at an elevation of 13.0 feet above mean low water along the westerly 5,300 feet of the improvement fronting the bluff area and along the easterly 2,250 feet fronting the barrier bar beach and a minimum width of 150 feet at the same elevation along the remaining 5,900 feet of the improvement fronting the boardwalk area in the central portion. The fill material would be placed on a foreshore slope of 1 on 20. A 560-foot long terminal jetty is provided at the Nissequogue River to hold the beach and act as a barrier to the littoral drift presently moving into the river

channel. Periodic nourishment of the restored beach would be provided for a period of 10 years after placement of the initial fill. In the event that the annual losses of beach fill are substantially greater than that anticipated, the improvement provides for construction of five groins, as required, to stabilize and to hold the restored beach.

95. The improvement would reduce erosion of the bluff and backshore beach development due to wave attack and runup. It would stabilize the migration of the barrier bar, help to keep the entrance channel of the Nissequogue River clear from shoaling, and prevent large losses of beach material. The improvement is expected to reduce the losses of valuable parklands due to erosion. The increased beach areas at Sunken Meadow State Park and at Callahans Beach would accommodate a much larger portion of the growing recreational bathing demand.

96. Caumsett and Wildwood State Parks. Plans of improvement similar to the one at Sunken Meadow State Park, were considered at Caumsett and Wildwood State Parks which have shore lengths of 11,900 feet and 7,700 feet, respectively. The park at Wildwood has been partially developed while at Caumsett, no development has been accomplished. Both parks are well endowed with natural beauty and fish and wildlife. Detailed studies and analyses indicated that the improvements were economically feasible. However, local interests requested that no further consideration be given to plans in these areas at this time pending further increases in recreational demands. The plans considered for these areas, but not recommended due to lack of local cooperation, are shown in figure H2 of appendix H.

97. Asharoken Beach. Consideration was given to a plan of improvement for hurricane flood protection at Asharoken Beach. The plan considered construction of dunes or floodwalls along the shores of Long Island Sound and Northport Bay and a barrier structure across Duck Island Harbor, to provide protection against a standard project hurricane surge occurring coincident with a mean tide which would produce a design stillwater elevation of 12.0 feet above mean sea level. Preliminary study and analysis indicated that the plan was not economically feasible.

98. Port Jefferson Harbor and vicinity. Consideration was also given to a plan of improvement for hurricane protection at Port Jefferson Harbor and vicinity. The plan provided for construction of a hurricane barrier across Port Jefferson Harbor, generally along the alignments of the barrier bars at the entrance, and for construction of a gated navigation opening on the site of the existing entrance. The improvement provided for protection against a standard project hurricane surge occurring coincident with a mean tide which would produce a design stillwater elevation of 11.0 feet above mean sea level. The low shore areas in Port Jefferson Harbor, Conscience Bay, Setauket Lakes, and in Setauket Harbor would all be afforded protection by this plan. Preliminary study and analysis indicated that the plan was not economically feasible.

99. Section 103 of the River and Harbor Act of 1962. This Act, as amended, provides authority for the Chief of Engineers to develop and construct small shore and beach restoration and protection projects that have not already been specifically authorized by Congress. A project is adopted for construction under section 103 only after detailed investigation and study clearly shows the engineering feasibility and economic justification of the project. Each project must be complete, economically justified, and is limited to a Federal cost of not more than $500,000. This Federal cost limitation also includes all project related costs for construction, investigations, inspections, engineering, preparation of plans and specifications, supervision and administration. A small beach erosion control project developed under section 103 is formulated to provide the same complete within-itself project that would be recommended under regular authorization procedures. No additional work should be required to assure effective and successful operation of the project. An increment or portion of a larger overall project is not eligible for construction under this program.

100. The section 103 authority and procedure was discussed with local interests during meetings and conferences. It was learned that there were several shore locations in the study area which might be eligible for consideration under the section 103 authority. Local interests were advised that formal requests to the District Engineer for the development of small beach erosion control projects under this procedure could be initiated by them for these locations.

XI. PROJECT FORMULATION

101. GENERAL. Economic feasibility is the primary criterion in determining the eligibility of a considered improvement for authorization for construction. The improvement must provide a practicable means of fulfilling an existing or prospective need. Formulation of the plan of improvement requires the comparison of alternatives to identify the most economic improvement. This improvement is optimized to develop a maximum excess of annual benefits over annual costs.

102. IMPROVEMENTS CONSIDERED. No hurricane protection could be justified due to the infrequency of damaging storms and the low degree of resulting damages. Based on shore ownership and economics, shore protection, beach restoration and backshore protection could be justified for only Sunken Meadow, Wildwood and Caumsett State Parks.

103. An economic comparison of the plans considered showing the excess annual benefits over annual costs and the benefit cost ratios are as follows:

State Park	Annual benefits (dollars)	Annual charges (dollars)	Excess benefits (dollars)	Benefit to cost ratio
Sunken Meadow	707,600	340,400	367,200	2.1
Wildwood	319,700	283,600	36,100	1.1
Caumsett	381,500	363,800	17,700	1.05

However, the local cooperating agency requested consideration of the improvement only for Sunken Meadow State Park at this time, based on contemplated use of the park.

104. The recommended plan for Sunken Meadow State Park and Callahans Beach was developed to correct a beach erosion problem and to achieve the optimum recreational use of the shore area. In the project formulation, consideration was given to four plans having varying beach berm widths to determine the optimum plan of improvement. It was found that plan optimization would be achieved by Plan 1 which provides for a minimum berm width of 100 feet to protect the backshore area along the bluff and barrier beach and a berm width of 150 feet along the boardwalk to optimize the recreational beach use that could be supported by appurtenant park facilities in the limited backup area of the park. Lesser berm widths (Plans 3 and 4) were found to be inadequate, while a greater berm width (Plan 2) was found to be excessive in cost to meet shore and recreational needs. Data concerning the selection of the optimum level of development are presented in table 8.

TABLE 8 - INCREMENTAL ANALYSIS OF DEGREE OF DEVELOPMENT FOR SUNKEN MEADOW STATE PARK, AND CALLAHANS BEACH, NEW YORK

Description	Plan 1	Plan 2	Plan 3	Plan 4
Minimum berm width	100 feet	125 feet	75 feet	50 feet
Total project cost	$4,392,000	$5,540,000	$3,656,000	$2,896,000
Average annual charges	$ 340,400	$ 421,300	$ 300,500	$ 259,000
Average annual benefits	$ 707,700	$ 756,900	$ 551,600	$ 394,800
Benefit-cost ratio	2.1 to 1	1.8 to 1	1.8 to 1	1.5 to 1
Excess benefits	$ 367,200	$ 335,600	$ 251,100	$ 135,800

XII. ECONOMIC ANALYSIS

105. ESTIMATES OF FIRST COST. Detailed cost estimates showing quantities and unit costs based on March 1969 prices are given in appendix J. The estimates of first cost of all work involved in the considered plan of improvement described above are summarized in table 9 broken down by principal features and between Federal and non-Federal costs. Included are allowances for contingencies and cost of engineering and design, and supervision and administration. Preauthorization study costs totaling $177,000, all of which are Federal cost, are excluded. The basis for apportionment of the costs between Federal and non-Federal interests are given in section XIII of this report.

106. ESTIMATES OF ANNUAL CHARGES. A summary of the estimated annual charges broken down between Federal and non-Federal interests is given in table 9. Details are contained in appendix J. An interest rate of 4.625 percent has been used for the Federal investment. The non-Federal investment is considered to be of a local public nature, requiring a 4.625 percent interest rate. A useful life of 50 years has been used for amortizing the improvement. No interest during construction is included since the initial work would require less than two years for completion. The basis for apportionment of the annual charges between Federal and non-Federal interests is given in section XIII of this report.

TABLE 9 - ESTIMATED FIRST COST AND ANNUAL CHARGES OF CONSIDERED PLAN FOR SUNKEN MEADOW STATE PARK, NEW YORK
(March 1969 price levels)

I - ESTIMATED FIRST COST

Item	Description	Quantity	Unit Price (dollars)	Total Cost (dollars)
Federal				
1.	Beach fill	1,280,000 C.Y.	1.70	$2,611,000[a]
2.	Jetty	11,100 Tons	16.00	214,000[a]
3.	Groins	54,700 Tons	16.00	1,050,000[a]
4.	Pipe railing	1,000 Feet	10.00	12,000[a]
5.	Engineering and design			194,000
6.	Supervision and administration			311,000
7.	Subtotal			$4,392,000
8.	Less local contribution			1,392,000
9.	Total Federal first cost			$3,000,000
Non-Federal				
10.	Cash contribution			$1,392,000
11.	Lands, easements and rights-of-way			0
12.	Total non-Federal first cost			$1,392,000
13.	Percent of total			31.7
Total First Cost				$4,392,000[b]

II - ESTIMATES OF ANNUAL CHARGES[c]

Item	Description	Cost (dollars)
Federal		
1.	Interest and amortization (4-5/8 percent)	$154,900
2.	Beach nourishment	68,300
3.	Subtotal	$223,200
Non-Federal		
4.	Interest and amortization (4-5/8 percent	$ 71,900
5.	Beach nourishment	31,700
6.	Maintenance - Jetty	2,300[d]
7.	Maintenance - Groins	11,000
8.	Subtotal	$116,900
Total Federal and Non-Federal Annual Charges		$340,100

(a) Includes contingencies allowance of 20 percent.
(b) Excludes preauthorization study costs of $177,000 and aid to navigation cost of $6,700.
(c) Excludes annual maintenance cost of $300 for aids to navigation.
(d) Includes annual maintenance cost of $100 for pipe railing.

107. ESTIMATES OF BENEFITS. Benefits are anticipated from the considered shore protection improvement in the form of increased recreational beach use, recreational fishing, decreased maintenance costs, and from prevention of land loss by erosion. The evaluated annual benefits, which are based on March 1969 price levels, are summarized in table 10. Details are contained in appendix K.

TABLE 10 - SUMMARY OF EVALUATED ANNUAL BENEFITS
(March 1969 price levels)

Type of benefits	Value (dollars)
Recreational beach use	$668,500
Recreational fishing	26,100
Decrease in maintenance	10,000
Prevention of land loss	3,000
Total benefits	$707,600

108. JUSTIFICATION OF IMPROVEMENTS. The estimated annual charges are $340,400. The estimated annual benefits are $707,600 The ratio of annual benefits to annual costs is $707,600/$340,400 = 2.1 to 1. The improvement would be economically justified.

XIII. ALLOCATION AND APPORTIONMENT OF COSTS

109. ALLOCATION. The considered improvement at Sunken Meadow State Park is a single purpose improvement for shore protection and the costs are entirely for that purpose.

110. APPORTIONMENT. The apportionment of the first cost and annual charges of the considered plan of improvement along the shores of Sunken Meadow State Park and Callahans Beach, between Federal and non-Federal interests is shown in table 9. The apportionment is in accordance with present Federal law and policy governing participation in shore protection improvements as established by Public Law 826, 84th Congress, as amended by Public Law 87-874 of the River and Harbor Act of 23 October 1962. The basis for apportioning the costs is described in the following paragraphs.

111. Apportionment of cost of shore protection improvements depends upon the Federal and non-Federal interests in a shore protection project. The Federal interest is the benefit accruing to the United States as a landowner. No frontage is owned by the United States within the area of the considered improvement. Non-Federal public interest is (a) the benefits accruing to a State or political subdivision thereof as a landowner; (b) the benefits accruing to the general public through use of the publicly-owned property; and (c) benefits from public use or the protection of nearby public property arising from protection of non-public shores. The apportionment of costs for the considered shore protection is based on the present non-Federal public ownership and general public use of the shore frontage covered by the considered shore improvement.

112. Under Public Law 826, 84th Congress, as amended by Public Law 87-874 (River and Harbor Act approved 23 October 1962) Federal contribution toward the cost of construction of protective works along publicly-owned shores is authorized up to one-half of the cost, including periodic beach nourishment for a length of time to be specified by the Chief of Engineers, except as follows. Federal participation in the cost of a project for restoration or protection of State, county, and other publicly-owned shore parks and conservation areas may be, in the discretion of the Chief of Engineers, not more than 70 percent of the total cost exclusive of land costs, when such areas meet the following requirements: (a) include a zone which excludes permanent human habitation; (b) include, but are not limited to recreational beaches; (c) satisfy adequate criteria for conservation and development of the natural resources of the environment; (d) extend landward a sufficient distance to include, where appropriate, protective dunes, bluffs, or other natural features which serve to protect the uplands from damage; and (e) provide essentially full park facilities for appropriate public use, all of which shall meet the approval of the Chief of Engineers.

113. Shores other than public are eligible for Federal assistance if there is a benefit such as that arising from public use, or from the protection of nearby public property, or if the benefits to those shores are incidental to the project. The extent of Federal contribution depends upon the degree of such benefits but is also not to exceed one-half of the cost incident thereto.

114. The District Engineer considers that the Sunken Meadow State Park qualifies as a park and conservation area under the authority described in paragraph 112 and that it is eligible for Federal participation of 70 percent in the first cost of shore protection along the park shore. Federal participation in shore protection along Callahans Beach, which is publicly-owned, is not considered to qualify as a park or conservation area, and therefore is limited to 50 percent of the cost of such protection. On the basis of the eligibility of Federal participation along the shore of the entire considered improvement, the percent of Federal participation in the improvement is computed as 68.3 percent. No Federal contribution is authorized towards shore protection maintenance work.

115. Maintenance of the restored beach would be a responsibility to be undertaken by local interests. However, the District Engineer considers periodic beach nourishment to be the most suitable and economic remedial measure available to provide stability of the shore in the area and that such nourishment should be construed as construction that is eligible for Federal participation on the same basis as the initial project. For the considered plan of improvement, he believes that the period for providing beach nourishment should not extend beyond 10 years after completion of the initial work, in order to permit the reevaluation of benefits, methods and techniques at that time.

116. Details of shorefront ownership, percent of Federal participation, and apportionment of first costs and annual charges for the considered plan of improvement are given in appendix J of this report.

XIV. EFFECT OF CONSIDERED PLAN OF IMPROVEMENT ON THE ENVIRONMENT

117. ENVIRONMENT. The plan of improvement at Sunken Meadow State Park would have no adverse effect on the quality of environmental features in the proposed project area. The plan would enhance the environment of the area by (a) restoring the protective beach and adding beach area for recreational use; (b) preserving the natural bluff and backshore areas; (c) permitting use of the jetty at the Nissequogue River by fisherman; and (d) by preventing beach sand from shoaling the entrance to the Nissequogue River and, thus reduce future hazards to recreational boating in this waterway. As a result of this plan the park would be able to serve a greater number of people and still retain its present environmental characteristics.

XV. COORDINATION WITH OTHER AGENCIES

118. GENERAL. The report was coordinated with various Federal, State and local agencies such as the Federal Water Pollution Control Administration, United States Fish and Wildlife Service, United States Bureau of Outdoor Recreation, United States Coast Guard, New York State Office of Planning Coordination, New York State Department of Public Works and New York State Conservation Department. Statements received from these agencies regarding the report and the considered improvement at Sunken Meadow State Park are given in appendix M of this report.

119. A public hearing on problems caused by storms and hurricanes along the north shore and eastern forks of Suffolk County was held on 19 January 1956 in Riverhead, New York, to obtain local views concerning the study of hurricanes authorized by Public Law 71, 84th Congress. A number of meetings were held in the District office and in the field with Federal, State and local officials during the development of various plans of improvement. Meetings were held on 28 June and 21 July 1967 to explain the plan of improvement and were attended by Federal, State and local officials. A digest of the public hearing is given in appendix L of this report. Details of the coordination activities are given in paragraphs 120 to 125.

120. Federal Water Pollution Control Administration. This agency suggested that particular attention be focused on the quality of the fill to be used so as not to impair the water quality off the beach area.

121. United States Fish and Wildlife Service. This agency indicated that the considered improvement would have no permanent adverse effect upon fish and wildlife resources. The Fish and Wildlife Service recommended that the jetty should have a relatively smooth flat surface and be provided with a guard rail along its outer edges for the safety of the fishermen and that the top width of the jetty should be at least 12 feet, to avoid unnecessary crowding. It was indicated that if the jetty were constructed as recommended, it would yield an additional annual benefit of 17,400 fisherman-days having a net recreational value of $26,100.

122. Bureau of Outdoor Recreation. This agency indicated that there was no conflict between the considered improvement and Bureau programs, with the possible exception of the removal of sand from offshore borrow sources. It is indicated that the benefits which would accrue to the improvement would be in accord with the objectives of New York's Statewide Comprehensive Outdoor Recreation Plan.

123. Third United States Coast Guard District. This agency has indicated the need for navigation aids, and the cost thereof, required after construction of the proposed jetty at the entrance to the Nissequogue River.

124. New York State Office of Planning Coordination. This office acted for the Tri-State Transportation Commission in coordinating the review of this report with State, regional and local planning agencies in accordance with review procedures established by the Commission which has been designated as the New York-New Jersey-Connecticut areawide planning agency under section 204 of the Demonstration Cities and Metropolitan Development Act of 1966 (Public Law 89-754; Statute 1263). The New York State Office of Planning Coordination indicated that the considered improvement was consistent with State, regional and local planning programs.

125. New York State Conservation Department. This agency indicated that the considered plan of improvement for Sunken Meadow State Park and Callahans Beach is acceptable to both the Conservation Department and the Long Island State Park Commission.

XVI. LOCAL COOPERATION

126. CONDITIONS. In accordance with Federal laws and policies, local interests would be required to bear 31.7 percent of the total first cost of the considered plan of improvement at Sunken Meadow State Park, a sum presently estimated at $1,392,000, and all annual maintenance and operation costs in the amount of $116,900 which includes $31,700 for periodic beach nourishment for a 10 year period. Detailed conditions of local cooperation are listed in the section under "Recommendations".

127. AGENCY. The Department of Public Works, the local cooperating agency at the start of the study, was dissolved under a reorganization of State agencies on 1 September 1967. Its responsibility for flood control and water resources activities was assigned to the New York State Conservation Department as the official coordinating agency for Federal improvements.

128. STATUS. The New York State Conservation Department has furnished a letter of intent indicating that it is willing to sponsor the required conditions of local cooperation for the considered plan of improvement at Sunken Meadow State Park within budgetary limitations. A copy of this statement is included in appendix M of this report.

XVII. DISCUSSION

129. CONDITIONS. Erosion has caused a significant recession of the shoreline throughout most of the study area and has reduced the effectiveness of natural protective beaches. As a result, wave attack occurring during past hurricanes and extratropical storms has damaged the shorefront development.

130. Low-lying shore areas at Asharoken Beach, Crab Meadow, Port Jefferson Harbor, and Hashamomuck Beach have been inundated by high tides during hurricane storms. This inundation has resulted in flood damage to property and hardships to families in these areas. The hurricane of 31 August 1954 which produced the maximum tides of record in the study area, caused total known damages in excess of $700,000 (1954 prices). Recurrence of this storm would cause a total of $1,083,800 (March 1969 prices) in primary physical and non-physical damages in the study area.

131. REQUESTS OF LOCAL INTERESTS. At the public hearing held at Riverhead, New York, on 19 January 1956, local interests and private individuals requested various types of improvement, such as groins along shores fronting high bluff areas, road raising and beach improvements along low-lying shore areas, and bluff protection for areas where residential developments are threatened. At Caumsett, Sunken Meadow and Wildwood State Parks, studies were requested to prevent storm damages. Also, a localized storm warning system and information for eastern Long Island were requested to aid property owners in fighting erosion and tidal flooding.

132. PLANS CONSIDERED. Plans of improvement for shore protection were considered for Caumsett, Sunken Meadow and Wildwood State Parks. Plans of improvement for hurricane protection were also considered for Asharoken Beach and Port Jefferson Harbor. The plans considered for the three State Parks were found to be economically feasible. However, local interests later requested that no further consideration be given to the improvements at Caumsett and Wildwood State Parks. The improvements considered at Asharoken Beach and Port Jefferson Harbor were found not economically justified by the evaluated benefits. Detailed consideration was not given to problem areas where there was insufficient public ownership or use. However, plans of improvement and corrective measures that may be undertaken by local interests were suggested for these problems. In problem areas such as at Old Field Point, Scotts Beach and Wading River Landing the State has constructed shore protection improvements. The barrier beach at Asharoken Beach is still overtopped even though massive beach fills have been placed. Erosion problems at Short Beach and Cedar Beach have been corrected by spoiling of beach material dredged from adjacent harbors.

133. A storm warning system has been instituted by the Suffolk County Civil Defense Office in cooperation with the U. S. Weather Bureau Office in New York City. However, hurricane preparedness plans within affected communities need to be developed in accordance with National Research Project Report No. 28 of the Weather Bureau entitled "Model Hurricane Plan for a Coastal Community" which is included in appendix N of this report.

134. CONSIDERED PLAN. The considered plan of improvement at Sunken Meadow State Park, New York, including the shore at Callahans Beach, would provide for beach restoration and widening of 13,450 feet of the shorefront by the artificial placement of about 1,280,000 cubic yards of beach fill. The required beach fill would be obtained from offshore borrow sources in Smithtown Bay. A terminal jetty would be provided at the entrance to the Nissequogue River to minimize losses of beach fill into the entrance channel.

A pipe railing would be provided on top of the jetty to permit recreational fishing off the jetty. The improvement would also provide for construction of five groins to stabilize further and to hold the restored beach, if their need is demonstrated by experience. The berm of the restored beach is placed above the level of storm conditions occurring at least once a year. The design results in reduced annual maintenance of the beach and losses of park area.

135. Maintenance of the improvement would be entirely a local responsibility. Periodic beach nourishment is included as the most suitable and economic measure to provide stability of the shore. The source of material required for periodic nourishment is the same as that for the initial fill. Since such nourishment can be construed as a part of the construction works, it would be eligible for Federal participation on the same basis as the initial improvement. In order to permit reevaluation of benefits, methods and techniques, Federal participation in the periodic nourishment would not extend beyond 10 years after completion of the initial work.

136. COSTS. The total first cost of the considered shore protection improvement, based on March 1969 price levels, is estimated at $4,392,000, and excludes the preauthorization study cost of $177,000 and the navigation aids cost of $6,700. The total annual charges, based on a useful project life of 50 years and an interest rate of 4.625 percent, are estimated at $340,400, of which $100,000 is the annual cost of periodic nourishment, $100 is the maintenance cost for the pipe railing on the jetty, and $300 is the maintenance cost for aids to navigation. Since the initial work would require less than two years for completion, no interest during construction is included.

137. BENEFITS. The total annual benefit anticipated from implementation of the considered improvement, based on March 1969 price levels, is estimated at $707,600. The evaluated benefits consist of $668,500 from increased recreational beach use, $26,100 from recreational fishing off the jetty, $10,000 from reduction in beach maintenance cost and $3,000 from prevention of land loss due to erosion.

138. ECONOMIC EVALUATION. The ratio of annual benefits to annual costs is 2.1 to 1. The considered improvement would be economically justified.

139. APPORTIONMENT. The first costs and annual charges are apportioned between Federal and non-Federal interests in accordance with present Federal law and policy governing participation in shore protection improvements as established by Public Law 826, 84th Congress, as amended by Public Law 87-874 of the River and Harbor Act of 23 October 1962. On the basis of the eligibility of Federal participation along the shore of the considered improvement, the percent of Federal participation in the improvement including the cost of periodic nourishment was computed as 68.3 percent. No Federal contribution is authorized towards shore protection maintenance work. Therefore, the Federal share of the first cost is estimated at $3,000,000 (68.3 percent) and the non-Federal share at $1,392,000 (31.7 percent). The Federal

share of the total annual charges is estimated at $223,200 including $68,300 for periodic nourishment. The non-Federal share of the total annual charges is estimated at $116,900 including $31,700 for periodic nourishment.

140. CONDITIONS OF LOCAL COOPERATION. Federal participation in the considered improvement would be subject to the conditions that local interests would furnish the local cooperation as listed in the section under "Recommendations". The New York State Conservation Department which is the official cooperating agency has furnished a letter of intent indicating that it is willing to furnish the necessary local cooperation within budgetary limitations.

XVIII. CONCLUSIONS

141. FINDINGS. Erosion of beaches and high bluffs is generally a problem throughout the north shore of Long Island in Suffolk County. Public and private shorefront property is subject to storm damage from wave attack and to structural damage from failure of bluff slopes. Shore areas fronted by low-lying barrier beaches are subject to damages from tidal inundation during storms and to hardships and inconvenience when evacuation is necessary. The eroded beaches are inadequate to provide for the steadily increasing population which is creating a demand for additional recreation facilities.

142. The most suitable method of correcting beach erosion would be to restore and to widen protective beaches by the aritifical placement of sand, and to provide nourishment periodically to preserve them. Where losses of beach fill are excessively high, groins could be provided to hold restored beaches. Where bluffs are not sufficiently protected by fronting beaches, the toe of the bluff could be protected by sand fill, stone mounds, revetments or bulkheads. Erosion of a bluff slope by rainfall runoff could be corrected by intercepting the runoff with ditches and by restoration of the cover by planting of indigenous vegetation.

143. The low-lying shore areas could be protected against tidal inundation during storms by restoration of dunes and beaches, levees and floodwalls, barriers across inlets and bays or by a combination of these measures. Low-lying roadways extending along narrow barrier bars which are affected by tidal inundation and undermining could be raised to higher elevations and protected to remain passable under storm conditions.

144. The shore protection improvements which were considered for Caumsett, Sunken Meadow and Wildwood State Parks are economically justified by evaluated benefits. Improvements considered for hurricane protection at Asharoken Beach and Port Jefferson Harbor are not economically justified since the cost of providing the protective measures would be in excess of the benefits that could be reasonably assured from the required construction. Adoption of a Federal project is considered only at Sunken Meadow State Park as local interests have indicated they do not desire improvements at this time at Caumsett and Wildwood State Parks. The time required for completion of the work at Sunken Meadow State Park is estimated at less than

two years. Stability of the fill would be accomplished by periodic nourishment, or by groins if found to be necessary.

145. The total first cost of the considered improvement at Sunken Meadow State Park, based on March 1969 prices, is estimated at $4,392,000. The Federal share of the total first cost is estimated at $3,000,000 (68.3 percent). These estimates exclude the costs of preauthorization studies amounting to $177,000 and navigation aids estimated at $6,700. The Federal Government would participate in defraying a portion of the annual cost of periodic beach nourishment, presently estimated at $68,300 (68.3 percent) for a period not to exceed 10 years after completion of the initial work. Additional information on the considered improvement called for by Senate Resolution 148, 85th Congress, adopted 28 January 1958, is contained in the supplement to this report.

XIX. RECOMMENDATIONS

146. RECOMMENDATIONS. The District Engineer recommends adoption by the United States of a shore protection improvement at Sunken Meadow State Park, New York, including the shore at Callahans Beach, consisting of beach restoration and widening by artificial placement of approximately 1,000,000 cubic yards of beach fill along 2.6 miles of shorefront with a berm at an elevation of 13.0 feet above mean low water and a width of 100 feet along the easterly 2,250 feet of shore, thence a width of 150 feet in the central 5,900 feet of shore generally fronting the boardwalk area, and thence a width of 100 feet along the westerly 5,300 feet of shore fronting the bluff area, as shown on plate 41 of this report. The improvement includes construction of a 560-foot long stone terminal jetty at the Nissequogue River; construction of five groins, if the need is demonstrated by experience, to hold the restored beach; and appurtenant works required for recreational fishing off the jetty. The total Federal first cost of the improvement is presently estimated at $3,000,000 (68.3 percent of the total first cost of the improvement), exclusive of the cost of preauthorization studies and navigation aids. Federal participation in defraying the cost of periodic beach nourishment is also recommended initially for a period not to exceed 10 years after completion of the initial work, in order to permit the reevaluation of benefits, methods and techniques. The presently estimated total annual cost to the United States for periodic beach nourishment is $68,300 (68.3 percent of the periodic beach nourishment cost).

147. Federal participation in the recommended improvement would be subject to the conditions that local interests would:

a. Provide without cost to the United States all lands, easements, and rights-of-way, including borrow areas necessary for construction of the improvement;

b. Hold and save the United States free from damages due to the construction works;

c. Bear 31.7 percent of the total first cost, a sum presently estimated at $1,392,000, with the final apportionment of the first cost to be made after actual costs and values have been determined and based on the conditions of public use and ownership at the time of construction;

d. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army and provide periodic nourishment during the economic life of the shore protection works as may be required to serve the intended purpose subject to Federal participation in the cost of periodic nourishment for an initial period of 10 years, as recommended herein. The non-Federal share of nourishment costs for the 10-year period is presently estimated at $31,700 annually (31.7 percent of the cost of the nourishment);

e. Maintain during the economic life of the improvement continued public ownership and use of the non-Federal publicly-owned shores upon which the Federal participation in beach protection is based;

f. Control water pollution to the extent necessary to safeguard the health of bathers;

g. Provide at its own cost the facilities necessary to realize benefits evaluated for the considered improvement; and

h. Maintain the park so as to qualify for 70 percent Federal participation throughout the life of the improvement in such manner that it would:

(1) include a zone that excludes permanent habitation;

(2) include an area that contains, but is not limited to recreational beaches;

(3) satisfy criteria for conservation and development of the natural resources;

(4) extend landward a sufficient distance to protect the uplands from damage; and

(5) provide essentially full park facilities for public use, all of which shall meet the approval of the Chief of Engineers.

HARVEY C. JONES
Colonel, Corps of Engineers
District Engineer

ACKNOWLEDGEMENTS AND IDENTIFICATION OF PERSONNEL

1. This report was prepared by the New York District, Corps of Engineers, under the current direction of Colonel Harvey C. Jones, C of E, District Engineer.

2. The investigation and the preparation of the report were under the Staff supervision of:

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Persons participating in the detailed planning, studies and investigations, the drafting of report material, the development of technical specialties and reproduction of the report were:

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Mrs. Ray Goodfield, Secretary, Beach Erosion and Hurricane Section

Former New York District personnel that contributed to the preparation of the report were: Colonel R. T. Batson, Charles K. Panish, Samuel Gofseyeff, Morris Colen, and Harald O. Haakonsen.

3. Storm damage surveys in the study area were conducted under contract by the engineering firms of Norman Porter Associates and John Clarkeson.

4. The New York District, Corps of Engineers, is appreciative of the co-operation rendered in connection with the study of the:

Federal Water Pollution Control Administration
United States Fish and Wildlife Service
United States Bureau of Outdoor Recreation
United States Coast Guard
United States Weather Bureau
Brookhaven National Laboratory
New York State Conservation Department
Suffolk County Department of Public Works
Various municipal departments of the towns and villages of
Suffolk County within the study area.

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[First endorsement]

NADPL-F (23 Jun 69) 1st Ind
SUBJECT: North Shore of Long Island in Suffolk County, New York, Beach Erosion Control and Interim Hurricane Study

DA, North Atlantic Division, Corps of Engineers 12 May 1970

TO: Resident Member, Board of Engineers for Rivers and Harbors
Washington, D. C. 20315

1. I concur in the recommendation of the District Engineer. While I doubt that the five groins proposed will ever be needed, I recommend that if they are constructed, they be built incrementally to eliminate the possibility of starving the downdrift beach.

2. The application of the revised interest rate of four and seven-eighths percent to the recommended project results in an increase in annual charges to $349,500 with annual benefits remaining at $707,600. The resulting benefit-cost ratio is 2.0 to 1.

C. M. DUKE
Major General, USA
Division Engineer

APPENDIX J - ESTIMATES, ALLOCATION AND APPORTIONMENT OF FIRST COST AND ANNUAL CHARGES, AND ECONOMIC ANALYSIS FOR CONSIDERED PLAN AT SUNKEN MEADOW STATE PARK, NEW YORK

I. ESTIMATES OF FIRST COST

J1. GENERAL. This section presents detailed cost estimates, based on March 1969 prices, for shore protection for the considered plan of improvement discussed in section XI of the main report and appendix H. The estimates provide for construction of a beach, a jetty and five groins. Estimated quantities are based on surveys by the Corps of Engineers in the period June to October 1965. The overall plan of improvement and construction details are shown on plate 41 of the main report. The estimate of first cost contained in this appendix includes allowances for contingencies, engineering and design, and supervision and administration.

J2. The material for artificial fill would be obtained from an area in Smithtown Bay lying approximately one mile offshore of Sunken Meadow State Park. Also, material is available in the large shoal in the bay, offshore of the mouth of the Nissequogue River. The estimate of dredging cost which is shown in exhibit J1, is based on the use of a 27-inch hydraulic dredge with an estimated monthly output of 396,000 cubic yards. In addition, a booster would be provided to pump the dredged material along the beach. The provision of beach fill by hydraulic dredging was found to be the most economical method because of the high cost of truck-hauled fill. At the time of construction, consideration would be given to selecting a borrow area in the bay where dredging operations would benefit navigation if found economically feasible, and also to minimize any possible damage to the fish and wildlife resources in the area.

J3. The most desirable material for beach fill is a sand similar to or coarser than that presently composing the beach. Samples of beach and bottom materials were obtained along selected profiles during the field survey of June to October 1965 at and in the vicinity of Sunken Meadow State Park. Mechanical analyses of these samples were made and their characteristics summarized in table B2 of appendix B. Also, in connection with the Sand Inventory Program of Long Island Sound which was being conducted by the U. S. Army Coastal Engineering Research Center (CERC), core borings were taken along selected seismic sounding lines in Smithtown Bay in the vicinity of the park, and are shown on figure J1.

J4. Preliminary analyses of these borings made by CERC are given in exhibit J2 of appendix J and indicate the presence of a clean, uniform, generally fine to medium, grey quartz sand which is suitable for use as beach fill. The location of core 24 taken under the Sand Inventory Program lies seaward of the 30-foot depth contour and approximately midway

between ranges 21 and 22 taken for this report. Grain size distributions of beach and bottom samples taken along range 21 generally indicate a uniform, fine to medium sand very similar to the material found in core 24.

J5. From these data, it appears that suitable material is available in the bay area, but that detailed subsurface investigations will be needed prior to initiation of construction to locate the limits of the borrow area more accurately. For estimating purposes, it was assumed that the quantity of fill to be pumped would be 20 percent greater than the required quantity, to allow for the possibility of encountering some unsuitable material during dredging, and for minor modifications in dredging patterns to minimize damage to fish and wildlife resources in the bay.

J6. BEACH FILL. Detailed quantity and cost estimates for providing a beach adequate for shore protection for the considered plan of improvement are given in table J1. The unit price used in table J1 was derived from computations outlined in exhibit J1, which provides estimates for the cost of dredging a total of 1,280,000 cubic yards. The plan provides for beach widening between the westerly end of Callahans Beach and the easterly end of the beach at Sunken Meadow State Park to a minimum berm width of 100 feet along the westerly 5,300 feet of shore; 150 feet along the next 5,900 feet of shore to the east; and 100 feet along the remaining 2,250 feet of shore at the easterly end, all at a berm elevation of 13.0 feet above mean low water.

J7. JETTY. The cost estimate for providing a jetty at the easterly end of the beach on the west side of the Nissequogue River is included in table J1. The unit price used in table J1 was based on recent contract prices for similar structures built on the shores of Long Island. The jetty is intended to fix the migration of the barrier bar at the State park and to minimize the losses of beach material into the mouth of the Nissequogue River. The jetty would extend 560 feet seaward from the landward side of the barrier bar, across the beach and out into Smithtown Bay. The top elevation of the landward and seaward sections would be respectively 15.0 feet and 9.0 feet above mean low water. The jetty would be constructed with a minimum flat-top width of 12.0 feet. A pipe guard rail would be installed along its outer edged to permit use of the jetty by recreational fishermen. A total of 11,100 tons of stone would be required for the structure and approximately 1,000 feet of pipe railing.

J8. GROINS. The cost estimate for construction of five groins is included in table J1. The unit price used is the same as indicated for the jetty in paragraph J7. It was estimated that the five aforementioned groins could prevent high losses of beach material along the shore of the improvement and hold the restored beach, if so required. The actual need for groins could best be determined after placement of beach fill and experience with periodic beach nourishment. The groins would extend 430 feet to 510 feet seaward from the landward side of the shore into Smithtown Bay and would be spaced from 1,800 feet to 2,600 feet apart. The top elevation of the landward and seaward groin sections would be, respectively, 14.0 feet and 9.0 feet above mean low water. A total of 54,700 tons of stone would be required for the structures.

TABLE J1 - DETAILED ESTIMATE OF COST FOR IMPROVEMENT AT SUNKEN MEADOW STATE PARK, NEW YORK
(March 1969 price levels)

Item	Quantity	Unit Price (dollars)	Cost (dollars)
Beach fill	1,280,000 cu. yds.[a]	1.70[b]	$2,176,000
Jetty	11,100 tons	16.00[c]	178,000
Five groins	54,700 tons	16.00[c]	875,000
Pipe railing	1,000 feet	10.00	10,000
Contract cost			3,239,000
Contingencies			648,000
Subtotal			3,887,000
Engineering and design			194,000
Supervision and administration			311,000
Total First Cost[d]			$4,392,000

(a) Quantity to be pumped.

(b) Unit price for beach fill derived from exhibit J1.

(c) Unit price for stone based on contract prices for similar structures constructed on Long Island.

(d) Exclusive of cost for aids to navigation.

J9. NAVIGATION AIDS. Construction of the jetty would require installation of navigation aids which are currently estimated at a cost of $6,700. Annual maintenance of these aids are estimated at $300.

J10. SUMMARY. The total estimated cost of improvement as shown in table J1 is $4,392,000. This estimate excludes the preauthorization study cost of $177,000 and the aids to navigation cost of $6,700, both of which are Federal costs. The uniform feature breakdown of the estimated first cost in the same manner as prescribed for Project Cost Estimate (PB-3) in Chapter 3, Part I, of the Corps of Engineers Programming and Accounting Manual (EM 11-2-101) is given in exhibit J3.

II. ALLOCATION AND APPORTIONMENT OF FIRST COST AND ANNUAL CHARGES

J11. GENERAL. This section presents an analysis of the apportionment of first cost and annual charges for the considered plan of improvement based on present Federal law and policy governing shore protection improvements as described in paragraphs 109 to 116 of the main report. The first costs and annual charges are based on present estimates of costs and benefits, and are subject to change on the basis of actual costs and conditions at the time of construction.

J12. ANNUAL CHARGES. The estimate of annual charges for the considered plan of improvement, as shown in table J2, is based on the assumption that it would be publicly financed at an interest rate of 4.625 percent. Since the initial work would require less than two years for completion, no interest during construction is included. Amortization is based on an assumed useful project life of 50 years. The charges also include the annual cost of periodic beach nourishment and the maintenance of the jetty and groins as indicated in the following paragraphs.

TABLE J2 - ESTIMATE OF ANNUAL CHARGES FOR CONSIDERED PLAN AT SUNKEN MEADOW STATE PARK, NEW YORK
(March 1969 price levels)

Item	Cost (dollars)
Interest and amortization[a]	$226,800
Beach nourishment, 50,000 cu. yds. @ $2.00	100,000
Maintenance	
Groins, 550 tons stone @ $20.00	11,000
Jetty, 110 tons stone @ $20.00	2,200
Pipe railing[b]	100
Total annual charges[c]	$340,100

(a) The interest and amortization charges are based on an interest rate of 4.625 percent and a useful life of 50 years (capital recovery factor 0.05163).

(b) Based on 1.0 percent of first cost of railing.

(c) Exclusive of maintenance cost for aids to navigation, estimated at $300.

J13. An estimate of the annual cost of beach nourishment for the considered plan of improvement is given in table J2. The estimated quantity of annual nourishment required is based on a comparative study of volumetric changes made along profiles 23, 24 and 25 at Sunken Meadow State Park between 1836-38 to 1886, 1886 to 1965, and 1836-38 to 1965. Profiles for the 1836-38 and 1886 surveys were interpolated from available U.S. Coast & Geodetic Survey hydrographic sheets. The 1965 profiles were taken during the survey for the study. It was found that the maximum average annual rate of erosion along this shore was 3.4 cubic yards per linear foot. A rate of 3.5 cubic yards per linear foot was selected for the nourishment requirement. More detailed information on the comparative study is given in appendix E. A unit price of $2.00 per cubic yard of nourishment material has been used for estimating purposes. The annual cost of periodic beach nourishment is estimated at $100,000.

J14. Estimated annual costs for jetty and groin maintenance which total $13,200, are based on one percent of the quantity of stone required for the initial work and at a unit price of $20 per ton.

J15. APPORTIONMENT BETWEEN FEDERAL AND NON-FEDERAL INTERESTS. The apportionment of the first cost and annual charges between Federal and non-Federal interests for the considered plan is based on present Federal law and policy governing recreation and shore protection improvements as described in section XIII of the main report.

J16. First costs. The apportionment of the first cost is based upon the ownership of the shore within the project limits. The proposed improvement which encompasses both Sunken Meadow State Park and Callahans Beach is shown on plate 41 of the main report. An examination of the area of the improvement indicates that the 12,300 feet of shore at Sunken Meadow State Park which is owned by the State of New York, qualifies as a park and conservation area, because it meets the established criteria for such areas as listed in paragraph 112 of the main report. This category is eligible for Federal participation up to 70 percent of the first cost of protection along such shores. The remaining 1,150 feet of shore at Callahans Beach which is owned by the town of Smithtown is publicly-owned, non-Federal shore, but it does not meet the established criteria to qualify as a park and conservation area. Therefore, this category of public shore is eligible for Federal participation only up to 50 percent of the first cost of protection along such shores.

J17. On the basis of the eligibility of Federal participation in the proposed improvement as described in section XIII of the main report, Federal participation in the cost of the improvement is computed as follows:

$$0.70 \times \frac{\text{State Park frontage}}{\text{Total frontage}} + 0.50 \times \frac{\text{Town Beach frontage}}{\text{Total frontage}} =$$

$$0.70 \times \frac{12,300}{13,450} + 0.50 \times \frac{1,150}{13,450} = 0.683 \text{ or } 68.3\%$$

The apportionment of first cost is given in table J3. No costs are included for lands, easements, and rights-of-way as the shore of the improvement and access to it are publicly-owned.

TABLE J3 - APPORTIONMENT OF FIRST COST FOR CONSIDERED PLAN AT SUNKEN MEADOW STATE PARK, NEW YORK(a)

Item	Cost (dollars)
Construction cost	$4,392,000
Lands, easements, and rights-of-way	0
Total first cost	$4,392,000
Federal share (68.3%)	3,000,000
Non-Federal share (31.7%)	1,392,000
Cash contribution	$1,392,000

(a) Exclusive of cost of aids to navigation.

J18. Annual charges. Annual charges for periodic beach nourishment are divided between Federal and non-Federal interests on the same basis as the first cost of the considered plan, but Federal participation in the cost of such nourishment would not extend beyond 10 years after completion of the initial work, as discussed in paragraph 115 of the main report. Maintenance of groins and jetty would be a matter of local responsibility. A summary of the annual nourishment and maintenance costs for the considered plan as broken down between Federal and non-Federal interests is given in table J4. Apportionment of the annual charges for this improvement is given in table J5.

TABLE J4 - APPORTIONMENT OF ANNUAL NOURISHMENT AND MAINTENANCE COST FOR CONSIDERED PLAN AT SUNKEN MEADOW STATE PARK, NEW YORK(a)

Item	Annual Cost (dollars)
Beach nourishment	$100,000
Federal contribution (68.3%)	68,300
Non-Federal contribution (31.7%)	31,700
Maintenance(b)	13,300
Total Nourishment and Maintenance Cost	113,300
Total Federal(c)	68,300
Total non-Federal	45,000
Total Federal and non-Federal	$113,300

(a) See paragraph J15 for basis of apportionment between Federal and non-Federal.

(b) This item would be entirely a non-Federal cost.

(c) Exclusive of annual maintenance cost of $300 annual for aids to navigation which would be a Federal cost.

TABLE J5 - APPORTIONMENT OF ANNUAL CHARGES FOR CONSIDERED PLAN AT SUNKEN MEADOW STATE PARK, NEW YORK(a)

Item	Cost (dollars)
Federal	
First cost	$3,000,000
Interest and amortization	154,900
Periodic nourishment	68,300
Total Federal annual charges	$ 223,200
Non-Federal	
First cost	$1,392,000
Interest and amortization	71,900
Periodic nourishment	31,700
Maintenance	13,300
Total non-Federal annual charges	$ 116,900
Total annual charges	$ 340,100

(a) See table J4 for apportionment of annual nourishment and maintenance costs.

III. ECONOMIC EVALUATION

J19. ANALYSIS. An economic analysis of the considered plan of improvement at Sunken Meadow State Park based on data developed in this appendix and in appendix K is given in table J6. The benefit-cost ratio for the improvement is 2.1 to 1 with annual benefits of $707,600 and annual charges of $340,400 including annual maintenance cost of $300 for aids to navigation. The improvement is economically justified.

TABLE J6 - ECONOMIC ANALYSIS FOR CONSIDERED PLAN AT SUNKEN MEADOW STATE PARK, NEW YORK

Function	Annual benefits (dollars)	Annual charges(a) (dollars)	Benefit-cost ratio
Shore protection	$707,600	$340,400	2.1 to 1.0

(a) Includes maintenance cost for aids to navigation estimated at $300.

EXHIBIT J1-- COST OF DREDGING BY 27-INCH HYDRAULIC DREDGE FOR CONSIDERED PLAN AT SUNKEN MEADOW STATE PARK, NEW YORK
(March 1969 price levels)

	Item	
1.	Estimated quantity to be placed	
	a. Yardage to grade, cubic yards	1,067,000
	b. Allowable overpumping, cubic yards	213,000
	c. Total pay yardage (a+b), cubic yards	1,280,000
2.	Daily output of 27-inch hydraulic dredge with booster, cubic yards/day	13,200
3.	Effective working time per month, days/month	30
4.	Output of dredge per month, cubic yards/month	396,000
5.	Time required to complete job, months	3-8/30
6.	Monthly operating costs including booster	$300,000
7.	Total cost of job (5x6)	$981,000
8.	Material and construction costs (pipeline, ranges, base for booster, etc.)	$ 25,000
9.	Field engineering and supervision	$ 4,900
10.	Mobilization and demobilization	$600,000
11.	Subtotal (7+8+9+10)	$1,610,900
12.	Distributed costs (taxes, ins., soc. sec., etc.)	$ 30,400
13.	Vacation and holiday pay	$ 20,000
14.	Overtime pay	(a)
15.	Subtotal (11+12+13+14)	$1,661,300
16.	Contractor's overhead, 12%	$199,400
17.	Bond costs	$ 9,000
18.	Subtotal (15+16+17)	$1,869,700
19.	Profit, 15%	$280,500
20.	Total contract cost (18+19)	$2,150,200
21.	Estimated cost per cubic yard (20/1c) say	$1.70
22.	Revised total contract cost (21x1c)	$2,176,000
23.	Contingencies, 20%	$435,000
24.	Total direct cost (22+23)	$2,611,000

(a) Included in monthly cost - dredge based on 30 day month.

EXHIBIT J1

DEPARTMENT OF THE ARMY
COASTAL ENGINEERING RESEARCH CENTER
5201 LITTLE FALLS ROAD, N.W.
WASHINGTON, D.C. 20016

CEREN 7 November 1967

SUBJECT: NED Sand Inventory Program, Eatons Neck, Long Island Area

TO: District Engineer
ATTN: Mr. G. Nersesian, NANEN-Be
U. S. Army Engineer District, New York
111 East 16th Street
New York, New York 10003

1. Reference telephone conversations between Mr. Nersesian, NAN and Mr. Meisburger, CERC on 2 and 3 November 1967.

2. In compliance with your request samples from the New England Sand Inventory cores 23, 24, 25 and 25A were processed through the rapid sediment analyzer and results were reported by telephone. In confirmation of the telephone report the size analysis data is listed below. The intervals run are characteristic of the material above to the next sampling interval or the top of the core.

Core	Depth below Bottom	Percent Coarser		
		16	50	84
23	-2.0 ft	.465*	.342	.245
	-6.0 ft	.465	.335	.232
	-8.0 ft	.450	.331	.240
	-15.0 ft	.422	.302	.287
24	Top to -0.5 ft silt			
	-1.0 ft	.579	.392	.194
	-3.0 ft	.549	.346	.194
	-6.0 ft	.622	.457	.295
	-8.0 ft	.622	.414	.255
	-12.0 ft	.342	.197	.135
25	-1.0 ft	.481	.394	.271
	-6.0 ft	.465	.363	.268

*Size in millimeters

EXHIBIT J2

CEREN 7 November 1967
SUBJECT: NED Sand Inventory Program, Eatons Neck, Long Island Area

Core	Depth below Bottom	Percent Coarser 16	50	84
25 (cont'd)	-9.0 ft	.450	.331	.245
25A	Top	.549	.394	.300
	-7.0 ft	.507	.392	.277
	-14.0 ft	.515	.335	.242

3. The sand contained in these cores is a clean, grey, homogeneous quartz sand. Core 23 is 16.5 ft long, Core 24 is 12.5 ft long, Core 25 is 9.5 ft long and Core 25A is 15.0 ft in length.

Joseph M. Caldwell
JOSEPH M. CALDWELL
Acting Director

EXHIBIT J2 (Cont'd)

EXHIBIT J3 - UNIFORM FEATURE BREAKDOWN OF ESTIMATE OF FIRST COST FOR CONSIDERED PLAN AT SUNKEN MEADOW STATE PARK, NEW YORK[a]
(March 1969 price levels)

Feature No.	Item	Amount (dollars)
10	Jetty and groins[b]	$1,276,000[c]
17	Beach replenishment	2,611,000[c]
30	Engineering and design	194,000
31	Supervision and administration	311,000
	Total cost	$4,392,000
	Non-Federal first cost	$1,392,000
	Contingency Allowance	
	Estimated cost (features 10 and 17)	$3,887,000
	Direct cost	3,239,000
	Contingency allowance[d]	648,000
	Percent contingency	20.0

(a) Does not include preauthorization cost of $177,000 and aids to navigation cost of $6,700, which are entirely Federal costs.

(b) Includes cost of pipe railing.

(c) Includes contingencies.

(d) Total contingencies for features 10 and 17.

APPENDIX M - STATEMENTS FROM OTHER AGENCIES

M1. GENERAL. This appendix presents statements and letters received during coordination of the study and its findings with various Federal and State interests. The interested agencies are the Federal Water Pollution Control Administration, the U.S. Fish and Wildlife Service, the U.S. Bureau of Outdoor Recreation, the Third U.S. Coast Guard District, the now dissolved New York State Department of Public Works, the New York State Conservation Department, and the New York State Office of Planning Coordination. The views of these agencies concerning the considered plan of improvement at Sunken Meadow State Park and other aspects of the study are summarized and listed in this appendix. The New York State Conservation Department which is the official coordinating agency representing all local interests in connection with local cooperation for Federal projects involving water resources development, has furnished the necessary letter of intent concerning local cooperation (see statement M7).

M2. SUMMARY OF STATEMENTS. Statements received from other agencies are summarized in paragraphs M3 to M9.

M3. Federal Water Pollution Control Administration. This agency suggested that particular attention be focused on the quality of the fill to be used at Sunken Meadow State Park so as not to impair the water quality off the beach area (see statement M1).

M4. U.S. Fish and Wildlife Service. This agency indicated that the considered plan at Sunken Meadow State Park would have no permanent adverse effect upon fish and wildlife resources. They recommended that the jetty at the Nissequogue River should have a relatively smooth flat surface and be provided with a guard rail along its outer edges for the safety of the fishermen and that the top width of the jetty should be at least 12 feet, to avoid unnecessary crowding. It was also indicated that if the jetty were constructed as recommended, it would yield an additional annual benefit of 17,400 fisherman-days having a net recreational value of $26,100 (see statement M2).

M5. U.S. Bureau of Outdoor Recreation. This agency indicated that there was no conflict between the considered improvement at Sunken Meadow State Park and Bureau programs, with the possible exception of the removal of sand from offshore borrow sources. It also indicated that the benefits which would accrue to the project would be in accord with the objectives of New York's Statewide Comprehensive Outdoor Recreation Plan (see statement M3).

M6. Third U.S. Coast Guard District. This agency indicated the need for navigation aids on the considered jetty at Sunken Meadow State Park, and the cost thereof, required after construction of the jetty at the entrance to the Nissequogue River (see statement M4).

M7. New York State Office of Planning Coordination. This agency advised that the findings of the study had been reviewed with the Tri-State Transportation Commission, the State Department of Health and with the Nassau-Suffolk Regional Planning Board and indicated that the considered plan of improvement at Sunken Meadow State Park was consistent with State, regional and local planning programs (see statement M5).

M8. New York State Department of Public Works. This agency advised that beach widening and protection were urgently needed at Sunken Meadow and Wildwood State Parks and requested to have plans for Caumsett State Park dropped from further consideration at this time (see statement M6).

M9. New York State Conservation Department. This agency which has been assigned the responsibilities of the N.Y. State Department of Public Works for flood control furnished a letter of intent advising that the considered plan of improvement for Sunken Meadow State Park and Callahans Beach is acceptable to both the Conservation Department and the Long Island State Park Commission and that they are willing to sponsor the required conditions of local cooperation within budgetary limitations. A request was also made to defer further consideration of a plan of improvement for Wildwood State Park at this time (see statement M7).

UNITED STATES
DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
HUDSON-CHAMPLAIN AND METROPOLITAN COASTAL
COMPREHENSIVE WATER POLLUTION CONTROL PROJECT
METUCHEN, N. J. 08840

September 11, 1967

Refer to: 27.05

Mr. Frank L. Panuzio
Chief, Engineering Division
New York District
U. S. Army Corps of Engineers
111 East 16th Street
New York, New York 10003

Dear Mr. Panuzio:

This letter is in reply to your request for comments on plans of improvement for beach erosion control at Caumsett, Sunken Meadow, and Wildwood State Parks on Long Island.

We suggest that particular attention be focused on the quality of the fill to be used so as not to impair the water quality off the beach areas. This is particularly important in the vicinity of Sunken Meadow State Park, as the Nissequogue River has been designated by the New York State Department of Health as Class D waters, which precludes any use as fishing, bathing, or source of water supply. Thus the poor quality of the water, over the fill which is to be dredged, could adversely affect the quality of the fill.

We thank you for the opportunity of reviewing these plans of improvement.

FOR THE REGIONAL DIRECTOR:

Sincerely yours,

Paul De Falco, Jr.
Director

Address All Replies To:

Director
Hudson-Champlain Project
F. W. P. C. A.
Metuchen, N. J. 08840

STATEMENT M1

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
U. S. POST OFFICE AND COURTHOUSE
BOSTON, MASSACHUSETTS 02109

February 8, 1968

District Engineer
Corps of Engineers
U. S. Army Engineer District, New York
111 East 16th Street
New York, New York 10003

Dear Sir:

This letter constitutes our fish and wildlife conservation and development report on the planned beach erosion control improvement project at Sunken Meadow State Park, Suffolk County, New York as described in your letter dated July 1[illegible], 1967. This report has been prepared under the authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended, 16 U.S.C. 661-66 inc.), in cooperation with the Division of Fish and Game, New York State Conservation Department and has its concurrence as indicated by letter dated February 2, 1968. It has also been coordinated with and represents the views of the Bureau of Commercial Fisheries.

The project is being planned under authority of PL 520 of the 71st Congress, approved July 3, 1930 and by resolutions of March 20 and June 19, 1963 of the Senate and House Committees on Public Works in the 71st and 84th Congress, approved June 15, 1965.

It is our understanding that the original study of development included the entire north shore of Suffolk County from Cold Spring Harbor to Orient Point and that segments of this shoreline may be considered for development at a later date.

Sunken Meadow State Park is located northwest of Smithtown on the west side of the Nissequogue River.

The project area will extend the full 13,450-foot length of the park shoreline, and be approximately 520 feet in width. The initial fill will consist of 1,100,000 cubic yards of material placed over a water area of

approximately 127 acres. This area will have a supplemental annual nourishment which may be as much as 50,000 cubic yards, depending on the severity of beach erosion during the year. The berm area of the fill will be 100 to 200 feet wide and will have an elevation of 13 feet above mean low water. The fill area extending from the seaward edge of the berms into the bay will have a slope of 1 on 20 and will extend approximately 230 feet into the water. We understand that fill for the project will be obtained by hydraulic dredging 4,500 to 5,000 feet offshore of the park from a rectangular-shaped borrow site running parallel to the beach at a depth of 26 feet below mean low water. The offshore edge of the borrow site will be contiguous with the existing bottom slope. The inshore edge of the borrow site will have a ledge varying in height from one to six feet.

We understand that a 560-foot-long jetty will be constructed at the eastern end of the project. The width of this structure will be eight to 12 feet on top angling at a 1 on 1.5 slope to a base width of 36 feet. The jetty elevation above mean low water will vary in height from 15 feet elevation for the inshore 220 feet, to a nine-foot elevation on the seaward 280 feet of the jetty. Connecting these two sections of differing elevations will be a 60-foot section that slopes down from the 15-foot elevation to the nine-foot elevation. The construction material will be core stone, covered by a double layer of armor stone.

Water depths along the jetty will vary. At mean high water, approximately 340 feet of the jetty will be in water and the seaward end will be two feet above the water surface in a depth of approximately nine feet. At mean low water periods, approximately 240 feet of the jetty will extend into the water and the seaward end of the structure will have a water depth of approximately two feet. The eastern side of the jetty will border the western shoreline of the Nissequogue River.

Recreational activities within the park include golfing, horseback riding, picnicking, sun bathing, swimming, surf-fishing and shellfishing. Shellfish harvesting, however, is limited since park regulations prohibit their harvest during the bathing season. The total annual recreational use for the past three years has averaged one and one-half million visitor-days.

Throughout the project area, the marine bottom composition is primarily sand, with scattered boulders in the western one-third of the area. This combination of sand and boulders provides suitable habitat for such finfish species as striped bass, bluefish, winter and summer flounder, tautog and puffer (blowfish). Fishermen surf-fish throughout the year in

the areas outside of the designated swimming area. The gradual sloping bottom area in the eastern section of the project somewhat limits the fishing accessibility to deeper waters during low tide. In the western section, the deeper fishing waters are much closer to the shoreline.

The current average annual utilization by surf fishermen is estimated at 7,500 fisherman days. It is expected that the maximum annual usage of 15,000 fisherman-days will be reached by 1980. The average annual figure over the project life is 14,000 fisherman-days.

Some hard-shell clams and an abundant supply of blue mussels are present east of the centrally located swimming area. These resources are harvested on a recreational basis only. However, waterfowl, primarily the diving duck species, are attracted to this offshore area to rest and subsequently feed on the mussels in the shallow areas.

It is our opinion that there will be no permanent adverse effect on the fish and wildlife resources. Although the beach fill will destroy some of the existing shellfish beds and alter the habitat for finfish, the habitat change will be relatively insignificant. The shellfish are expected to re-establish themselves on the new fill. The project will have no effect on the amount of the surf fishing from the beach, that is, the fishing opportunities will be the same as under without-the-project conditions.

With the construction of a terminal jetty, the finfish habitat will be improved since several species including the tautog and puffer will be attracted to the structure to feed and to seek shelter. Bluefish and striped bass fishing will be enhanced by the accessibility of additional waters to the fishermen.

In order to attain maximum utilization by sport fishermen, the jetty should have a relatively smooth flat surface and be provided with a guard rail along its outer edges for the safety of the fishermen. It has been our experience that more non-fishermen than fishermen utilize the jetties; therefore, to avoid unnecessary crowding, the top width should be at least 12 feet. If constructed in this manner the jetty will yield an estimated benefit of 17,400 fisherman-days annually over the 50-year life of the project having a net recreational value of $26,100.

We recommend:

1. That the terminal jetty be constructed with a minimum flat-top surface width of twelve feet.

2. That the jetty be provided with a guard rail along its outer edges for the safety of the fishermen.

We wish to be advised as soon as possible, if as a result of your studies, it becomes necessary to modify your present plans so we can prepare a new report if needed.

Sincerely yours,

Richard E. Griffith

Regional Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF OUTDOOR RECREATION
128 N. BROAD STREET
PHILADELPHIA, PENNSYLVANIA 19102

IN REPLY REFER TO:
D64

September 6, 1968

Mr. Frank L. Panuzio
Chief, Engineering Division
New York District, Corps of Engineers
26 Federal Plaza
New York, New York 10007

Dear Mr. Panuzio:

I hereby acknowledge receipt of your letter of August 13, 1968, wherein is discussed a plan for improvement for beach erosion control at Sunken Meadow State Park in Smithtown, New York. The generalization of the plan of improvement by letter affords us only a superficial evaluation of the full effects of the proposed work. However, in response to your request for comments so that you might expedite submission of your report for approval of higher authority and concurrence of local interests, we herein submit our findings.

We have found no conflict between the proposed improvements and Bureau programs, with the possible exception of the effects of the removal of sand fill from offshore borrow sources.

We find that the benefits anticipated from implementation of the plan, i.e., prevention of loss of land due to beach and bluff erosion, reduction in maintenance of the beach, increased recreational bathing use of the added beach area, and recreational fishing use of the jetty at the Nissequogue River, are in accord with the objectives of New York's Statewide Comprehensive Outdoor Recreation Plan. In particular, the proposed work will significantly increase the quantity and quality of a resource which is in great demand in a location where the benefits are readily available to the residents of the New York City metropolitan area.

Your projection of the increase in beach attendance resulting from the proposed improvement is taken to be based on a direct proportionate increase between area of beach and bather capacity. We find however, that such a projection may not be a true representation of actual attendance. The facilities for parking, which is presently limited to an

STATEMENT M3

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instant capacity of 7,443 cars, and services such as bath houses are limiting factors. Unless these facilities are expanded the increased capacity of the beach may never be utilized.

An important benefit to be derived from the proposed improvement, but one which is difficult to appraise, is the improved quality of the recreation experience to be derived from a wide sandy beach at a site here-to-fore narrow and pebbly..

Sincerely yours,

Rolland B. Handley
Regional Director

By: George W. Davis

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

Address reply to:
COMMANDER (o)
Third Coast Guard District
Governors Island
New York, N.Y. 10004
(212) 264-8736

3260/oan
21 August 1968

From: Commander, Third Coast Guard District
To: District Engineer
New York District, Corps of Engineers

Subj: Required Navigational Aids for proposed Nissequogue River Jetty

Ref: (a) District Engineer ltr NANEN-Be dtd 9 Aug 68

1. In compliance with reference (a) you are advised that the proposed stone jetty into Smithtown Bay at the Nissequogue River will require a navigational light on its seaward end.

2. The initial cost of such a light and its supporting structure and foundation is $6700 with an annual maintenance cost of $300.

R. N. REA
By direction

STATEMENT M4

STATE OF NEW YORK • EXECUTIVE DEPARTMENT

OFFICE OF PLANNING COORDINATION

1841 BROADWAY, NEW YORK 10023

October 16, 1968

Mr. Frank L. Panuzio, Chief
Engineering Division
U. S. Army Corps of Engineers
26 Federal Plaza
New York, New York 10007

Re: Beach Erosion Control and Flood Prevention; North Shore of Long Island in Suffolk County

Dear Mr. Panuzio:

This is to advise you that the review of the above application has been completed as follows:

Regional Review - Affirmative Review - Tri-State Transportation Commission - August 15, 1968

State Planning Agency Review - The Office of Planning Coordination finds no conflict with regional plans.

State Functional Agency Review - Dept. of Health comments attached - October 3, 1968

Sub-Regional Planning Agency Review - Affirmative Review - Nassau-Suffolk Regional Planning Board, September 26, 1968.

These findings satisfy the requirements of Section 204 of the Demonstration Cities and Metropolitan Development Act of 1966, and your application has been found consistent with State, Regional and local planning programs. Copies of the review are attached for your information and use.

This information is forwarded in keeping with the procedures

STATEMENT M5

established, and this office is acting for the Tri-State Transportation Commission.

Sincerely,

Charles T. Lanigan Jr.

Charles T. Lanigan
State Review Coordinator

CTL/HE/rm
enclosures

TO: New York State Review Coordinator
FROM: Tri-State Staff
DATE: August 15, 1968

SUBJECT: BEACH EROSION CONTROL AT SUNKEN MEADOW STATE PARK

Applicant

New York District, U. S. Corps of Engineers

Project

Beach fill, a jetty and the construction of five groins, plus periodic replenishment of fill losses at Sunken Meadow State Park.

Estimated Cost

First cost: $3,933,000 (70% federal, 30% state)
Annual cost of beach nourishment: $100,000 (70% federal, 30% state)

Location

Sunken Meadow State Park, in the Town of Smithtown, on the north shore of Suffolk County.

Review

This project is the result of a survey of the north shore of Long Island in Suffolk County in the interests of beach erosion control and hurricane protection authorized by Congress in 1963. Four specific improvement proposals were developed from this survey, but only this one was accepted. Rejected were:

1. Caumsett and Wildwood State Parks - not recommended due to lack of local cooperation

2. Asharoken Beach - not economically feasible

3. Port Jefferson Harbor - not economically feasible

The project being advanced at Sunken Meadow State Park is to widen the beach by 150 feet along the central waterfront of the State Park (about one mile in length), by 100 feet along the secondary waterfront of the State Park (about half a mile in length on each side), and by 200 feet along the waterfront of the adjacent Town Park (about one-third mile in length). In addition, a jetty 560 feet long will be built at the east end of the State Park where it adjoins the channel entrance to the Nissequogue River. Also, five

groins (small jetties) will be built as found necessary.

The plan is acceptable to the State Conservation Department, the Long Island State Park Commission (which operates the Park) and the State Department of Public Works. The Corps of Engineers has also cleared with the Federal Water Pollution Control Agency and the U. S. Fish and Wildlife Service.

Conformity with Plans

Tri-State's preliminary land development plan - no conflict
Tri-State's preliminary recreation plan - no conflict
Tri-State's interim transportation plan - no conflict
New York State Plans - to be determined by SRC
Suffolk County Plans - to be determined by SRC

Comment

Since this project is to improve an existing regional park which Tri-State recognizes as a major feature of the Region's configuration, it is consistent with plans for land development and open space. Being a water-oriented park makes it especially valuable and desirable for intensive recreation purposes.

Nassau-Suffolk Regional Planning Board

Veterans Memorial Highway Hauppauge, L. I., N.Y. 11787
Area Code (516) 724-1919

September 26, 1968

Mr. Roger M. Darby
Metropolitan District Review Coordinator
State of New York, Office of Planning Coordination
1841 Broadway, New York, N.Y. 10023

Dear Mr. Darby:

Re: Beach Erosion Control and
Flood Protection, North Shore
of Long Island in Suffolk County

We have examined the draft of the proposal as submitted by your office in correspondence of August 21, 1968. We find this report to be consistent with the objectives of the county and, therefore, urge its support.

Very truly yours,

Lee E. Koppelman
Executive Director

LEK:hb
enc. Draft - Beach Erosion Control and Interim Hurricane Study
North Shore of Long Island in Suffolk County

HOLLIS S. INGRAHAM, M.D.
COMMISSIONER

STATE OF NEW YORK
DEPARTMENT OF HEALTH

84 HOLLAND AVENUE
ALBANY, NEW YORK 12208

ENVIRONMENTAL HEALTH SERVICES

DWIGHT F. METZLER, P.E.
DEPUTY COMMISSIONER

DIVISION OF PURE WATERS

October 3, 1968

Mr. Edward Schwartzman
Metropolitan District
Review Coordinator
Executive Department
Office of Planning Coordination
1841 Broadway
New York, New York 10023

Re: Beach Erosion Control and
Flood Protection-North Shore
of Long Island in Suffolk County

Dear Mr. Schwartzman:

The report, entitled, "Beach Erosion Control and Interim Hurricane Study-North Shore of Long Island in Suffolk County", dated February 1968, has been reviewed.

It is noted that a comprehensive sewerage study report prepared by Bowe, Walsh and Associates, dated 1967, proposes a sewage treatment plant and outfall sewer approximately one-half mile east of the mouth of the Nissequoque River terminating approximately one mile from Short Beach. Although the draft of the Beach Erosion report does not include Plate 41, showing the location of the proposed jetty in this area, it is unlikely that the jetty, as described, will interfere with the construction or the operation of the outfall.

We also have no information as to the location of Duck Island Harbor which makes it impossible to comment on the recommendations for Asharoken Beach.

Sincerely,

Maurice W. Grady, P.E.
Chief, Comprehensive Utilities
Planning Section

J. BURCH McMORRAN
SUPERINTENDENT

DIVISION OF CONSTRUCTION
ROBERT W. SWEET
CHIEF ENGINEER

BRIDGE DESIGN AND
CONSTRUCTION SUBDIVISION
V. J. BURNS
DEPUTY CHIEF ENGINEER

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

1220 WASHINGTON AVENUE
STATE CAMPUS

ALBANY, NEW YORK 12226

August 11, 1967

Mr. Frank L. Panuzio, Chief
Engineering Division
Department of the Army
New York District, Corps of Engineers
111 East 16th Street
New York, N. Y. 10003

Dear Mr. Panuzio:

This is in reply to your letter of July 31, 1967 concerning a beach protection program on the North Shore of Long Island. Your proposed plans will be given full consideration and we will keep you advised from time to time if revisions are thought necessary.

The Long Island State Park Commission advises us that beach widening and protection are urgently needed at Sunken Meadow and Wildwood State Parks. They would like to have plans for Caumsett Park dropped from the program since no bathing facilities are planned at this site and the shoreline requires no improvement.

Additional projects will be requested under the small project authority at Goldsmith Inlet and other locations desired by county and town officials.

Very truly yours,

V. J. Burns
Deputy Chief Engineer

By: A. W. Moon
A. W. Moon
Asst. Deputy Chief Engineer

AWM/WCW/b
cc: Mr. Shapiro
Mr. Kammerer
Mr. Haines

STATEMENT M6

STATE OF NEW YORK
CONSERVATION DEPARTMENT
ALBANY, NEW YORK 12226

R. STEWART KILBORNE
Commissioner
W. MASON LAWRENCE
Deputy Commissioner
LEIGHTON A. HOPE
Deputy Commissioner
ROBERT E. YOUNG
Deputy Commissioner
IRWIN H. KING
Secretary

Office of Central Engineering

May 11, 1970

Mr. Glenn H. Von Gunten, Chief
Engineering Division
Department of the Army
New York District, Corps of Engineers
26 Federal Plaza
New York, New York 10007

Dear Mr. Von Gunten:

Please refer to past correspondence relative to the State's position on the plans of improvement under consideration in the Federal beach erosion-hurricane protection study of the North Shore of Long Island, New York.

Your plan for the proposed improvement at Sunken Meadow State Park is, in general, acceptable to both this Department and the Long Island State Park Commission and we, therefore, are willing to sponsor the required conditions of local cooperation within budgetary limitations.

We suggest that you defer any action at Wildwood State Park at this time. If sometime in the future, beach conditions require further attention, we shall bring this up again for consideration.

Sincerely yours,
R. A. COOK
Director

By: _____
Eldred Rich
Assistant Director for Flood Control

RAC:ER:JFK:erb
cc: R. C. Boyce

STATEMENT M7

NORTH SHORE OF LONG ISLAND IN SUFFOLK COUNTY, NEW YORK
BEACH EROSION CONTROL AND INTERIM HURRICANE STUDY

INFORMATION CALLED FOR BY SENATE RESOLUTION 148, 85TH CONGRESS
ADOPTED 28 JANUARY 1958

1. EROSION AND FLOODING PROBLEMS. The study area covers the north shore of Long Island in Suffolk County, New York, from Cold Spring Harbor eastward to Orient Point. Erosion has caused a significant recession of the shoreline throughout most of the study area and has reduced the effectiveness of natural protective beaches. Wave attack occurring during past hurricanes and storms has damaged the shorefront development. Several low-lying shore areas have been inundated by extremely high tides during these storms, causing flood damages to property and hardships to the population. The mean ranges of tide vary from 7.4 feet at Cold Spring Harbor to 2.5 feet at Orient Point. The maximum observed tide in the study area is 9.45 feet above mean sea level, occurring at Port Jefferson Harbor during the hurricane of 31 August 1954.

2. IMPROVEMENTS CONSIDERED. Shore protection improvements were considered at Caumsett, Sunken Meadow and Wildwood State Parks. The plans would provide for beach fill, terminal groins, a jetty, periodic nourishment, and additional groins, if needed; and were found to be feasible at each location. However, at the request of local interests further consideration of the plans at Caumsett and Wildwood State Parks was not made at this time. Local interests indicated a desire for the plan developed at Sunken Meadow State Park. Hurricane flood protection improvements, providing dune and beach fill and navigation structures, were considered at Asharoken Beach and Port Jefferson Harbor. The improvements were not found to be economically justified at either location.

3. RECOMMENDED IMPROVEMENT. The recommended shore protection improvement at Sunken Meadow State Park, including 1,150 feet of shore at Callahans Beach, provides for: restoration and widening of 13,450 feet of beach by artificial placement of sand fill; construction of a jetty; and construction of five groins, if experience indicated their need. Stability of the fill would be accomplished by periodic beach nourishment. The useful project life of the improvement has been taken as 50 years.

4. FIRST COST. The estimated first cost of the recommended improvement based on prices and conditions as of March 1969 is as follows:

Federal	$3,000,000*
Non-Federal	1,392,000
Total	$4,392,000*

*Exclusive of cost of navigation aids which are estimated at $6,700.

5. ANNUAL COSTS AND BENEFITS. Annual costs and benefits for the recommended improvement computed on the basis of a useful project life of 50 years and an interest rate of 4.625 percent are as follows:

Annual costs	Federal	Non-Federal	Total
Charges	$154,900	$ 71,900	$226,800
Beach nourishment	68,300	31,700	100,000
Maintenance	0*	13,300	13,300*
Total	$223,200*	$116,900	$340,100*

*Exclusive of annual maintenance cost of $300 for navigation aids.

Annual benefits	$707,600
Ratio of benefits to cost (B/C)	2.1 to 1

6. APPORTIONMENT OF COSTS AND LOCAL COOPERATION. The estimated costs are apportioned in the report in accordance with Public Law 826, 84th Congress, as amended by Public Law 87-874 (River and Harbor Act approved 23 October 1962), which provides for Federal participation to the extent of 70 percent of the construction costs (including periodic beach nourishment for a limited period) for protecting publicly-owned shore parks and conservation areas, and to the extent of 50 percent of the cost along non-Federal public shores other than park and conservation areas. The report apportions $3,000,000 in first costs and $68,300 beach nourishment costs annually for a period of 10 years to the Federal Government. The Federal participation is subject to the conditions that local interests will:

a. Provide without cost to the United States all lands, easements, and rights-of-way, including borrow areas necessary for construction of the improvement;

b. Hold and save the United States free from damages due to the construction works;

c. Bear 31.7 percent of the total first cost, a sum presently estimated at $1,392,000, with the final apportionment of the first cost to be made after actual costs and values have been determined and based on the conditions of public use and ownership at the time of construction;

d. Maintain and operate all the works after completion in accordance with regulations prescribed by the Secretary of the Army and provide periodic nourishment during the economic life of the shore protection works as may be required to serve the intended purpose subject to Federal participation in the cost of periodic nourishment for an initial period of 10 years, as recommended herein. The non-Federal share of nourishment costs for the 10-year period is presently estimated at $31,700 annually (31.7 percent of the annual cost of nourishment);

e. Maintain during the economic life of the improvement continued public ownership and use of the non-Federal publicly-owned shores upon which the Federal participation in beach protection is based;

f. Control water pollution to the extent necessary to safeguard the health of bathers;

g. Provide at its own cost the facilities necessary to realize benefits evaluated for the considered improvement; and

h. Maintain the park so as to qualify for 70 percent Federal participation throughout the life of the improvement in such manner that it would:

(1) include a zone that excludes permanent habitation;

(2) include an area that contains, but is not limited to recreational beaches;

(3) satisfy criteria for conservation and development of the natural resources;

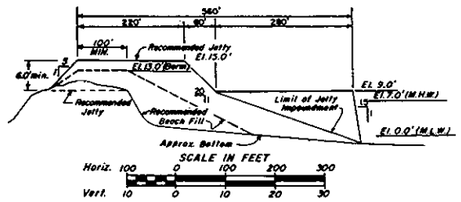
(4) extend landward a sufficient distance to protect the uplands from damage; and

(5) provide essentially full park facilities for appropriate public use, all of which shall meet the approval of the Chief of Engineers.

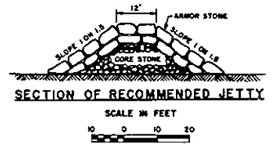
7. DISCUSSION. Economic analysis on the basis of a useful improvement life of 100 years would not result in a modification of the recommendations in the report. The benefit-cost ratio would increase from the favorable ratio of 2.1 to 1 for a 50-year life, to 2.2 to 1 for a 100-year life.

CORPS OF ENGINEERS

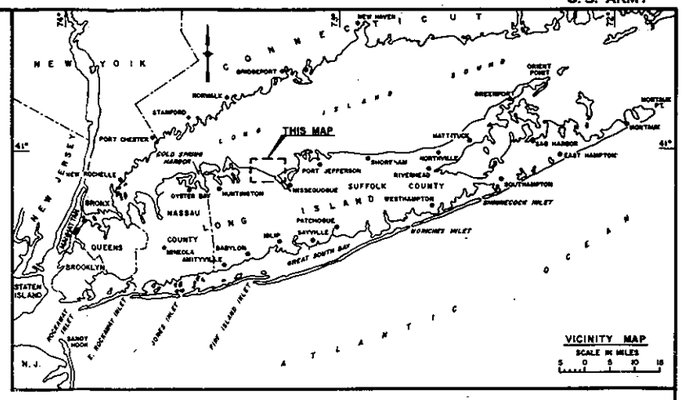
U.S. ARMY

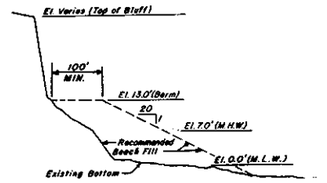


PROFILE OF RECOMMENDED JETTY AND BEACH FILL

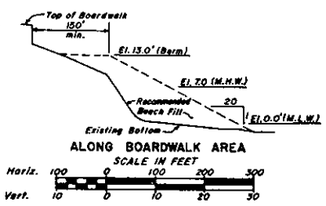


SECTION OF RECOMMENDED JETTY



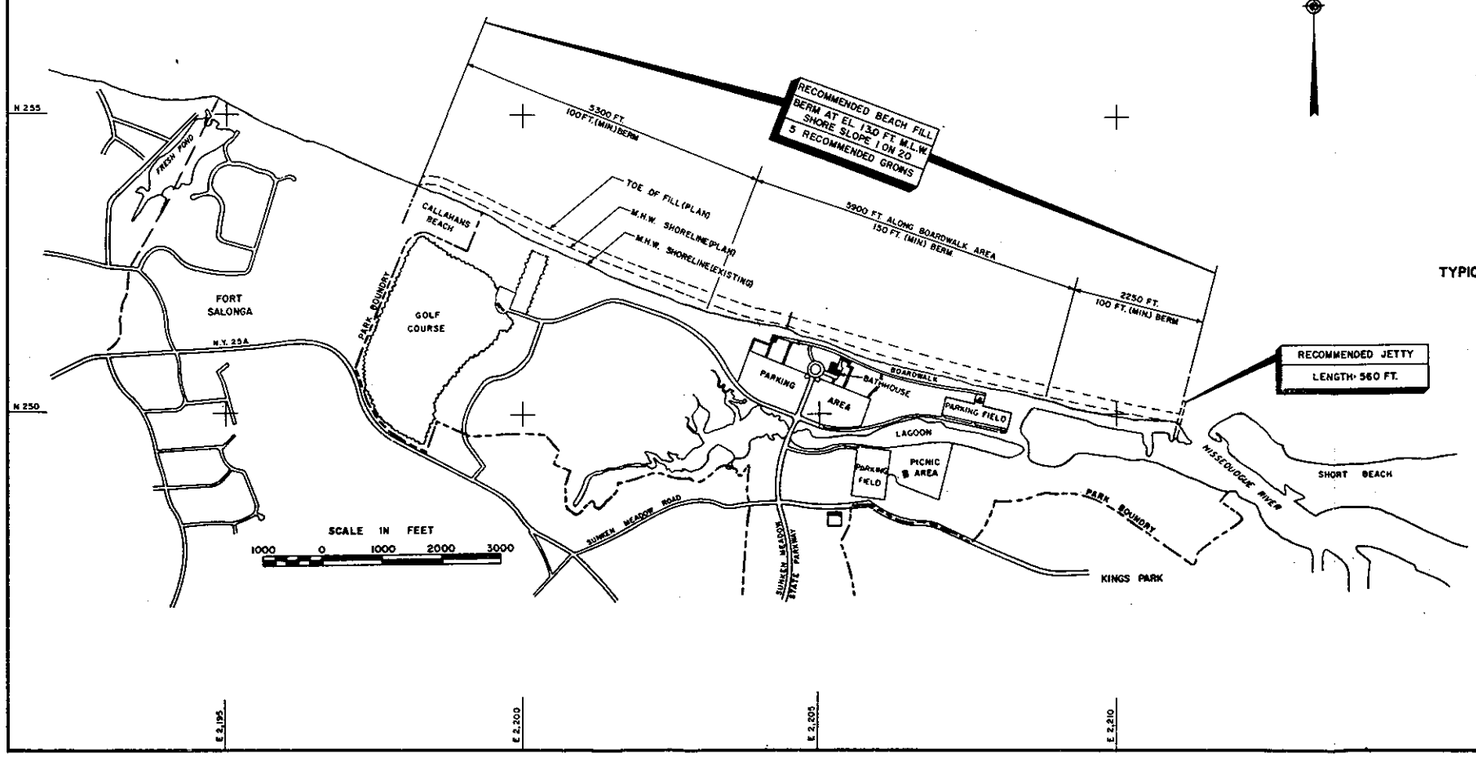


ALONG BLUFF AREA



ALONG BOARDWALK AREA

TYPICAL PROFILES OF RECOMMENDED BEACH FILL



BEACH EROSION CONTROL AND INTERIM HURRICANE STUDY
NORTH SHORE OF LONG ISLAND
SUFFOLK COUNTY, NEW YORK
SUNKEN MEADOW STATE PARK, N.Y.
RECOMMENDED PLAN OF IMPROVEMENT

DEPARTMENT OF THE ARMY
NEW YORK DISTRICT, CORPS OF ENGINEERS
NEW YORK, NEW YORK

SUBMITTED:	REVIEWED:	RECOMMENDED:
Chief, Design & Construction Division	Chief, Design & Project Planning Br.	Chief, Engineering Division
APPROVED: Colonel, Corps of Engineers, District Engineer	Drawn by J.P. Checked by J.O.	DRAWING NUMBER B.E.C. 14-5

TO ACCOMPANY SURVEY REPORT DATED 25 JUNE 1968

PLATE 41

76-424 O—72 (Face p. 98)